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MODEL 50525 (SP-1048)
BROADBAND SWEEPER SYSTEM

SYSTRON DONNER

OPERATION AND SERVICE MANUAL

MODEL 50525 (SP-1048)

BROADBAND SWEEPER SYSTEM

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SYSTRON MICROWAVE DIVISION DONNER CORPORATION

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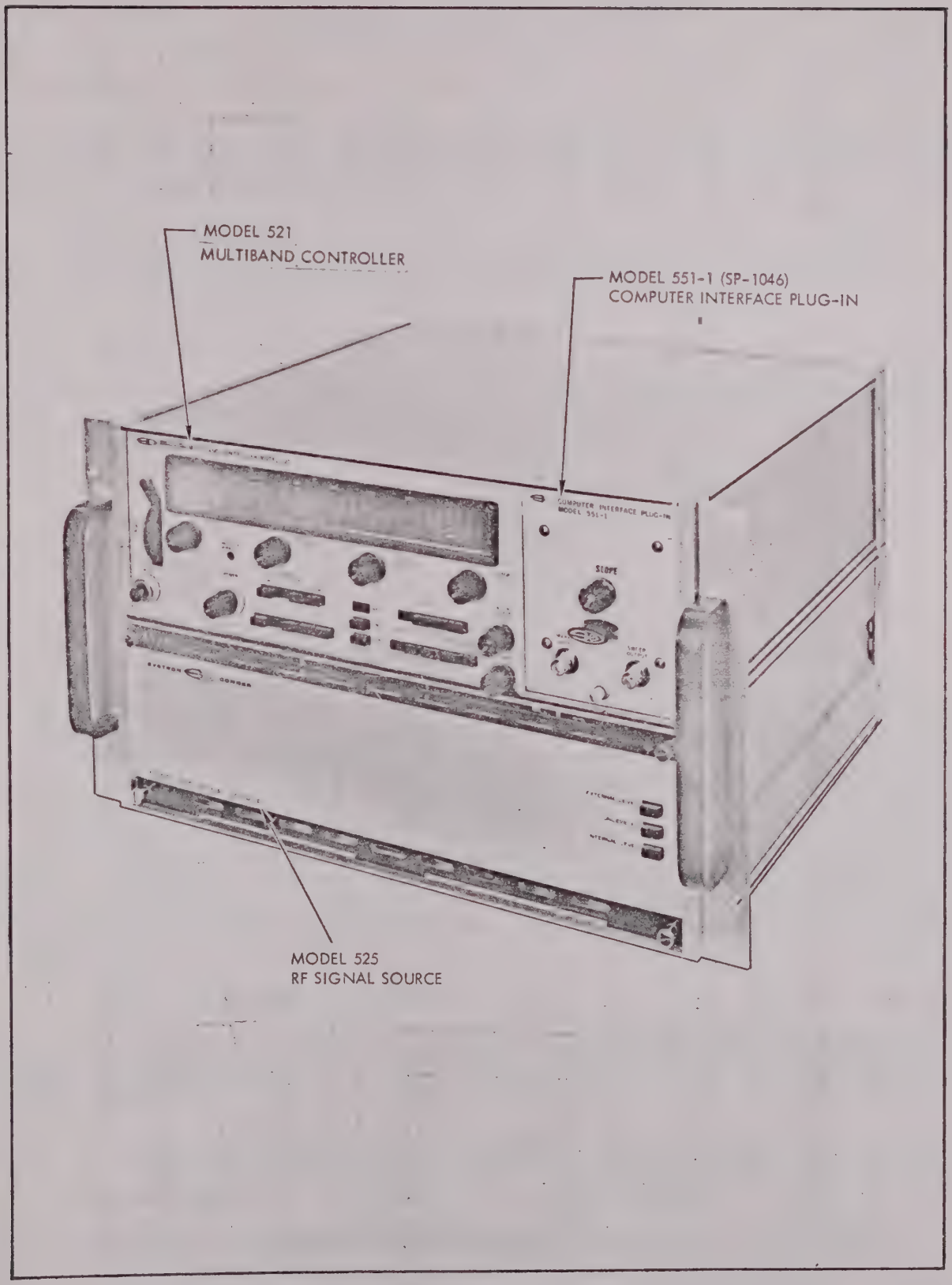


Figure 1-1. Model 50525 (SP-1048)
Broadband Sweeper System

SECTION I

INTRODUCTION AND DESCRIPTION

1.1 SCOPE

This manual provides operation and service instructions for the Systron-Donner Model 50525 (SP-1048) Broadband Sweeper System (figure 1-1), hereinafter referred to as the sweeper sytem.

The sweeper system, shown in figure 1-1, consists of a Model 521 Multiband Controller, a Model 551-1 (SP-1046) Computer Interface Plug-In, and a Model 525 RF Signal Source.

1.2 PURPOSE AND FUNCTION OF EQUIPMENT

The sweeper system (see figure 1-2) is a fully programmable, multiband sweep generator capable of producing rf signals in the range from 0.5 GHz to 12.4 GHz. This is accomplished in four bands, as follows:

Band	Frequency Range (GHz)
1	0.5 to 1.0
2	1.0 to 4.0
3	4.0 to 8.0
4	8.0 to 12.4

The frequency sweep across all or a portion of one of these bands (local or remote) or across all or a portion of two or more bands (remote only) can be programmed manually (local) by means of the Model 521 Multiband Controller, or may be programmed remotely by means of a remote control unit which supplies digital frequency information to the sweeper system. The Model 525 RF Signal Source generates the rf signal commanded by the Model 521 or the remote control unit. The Model 551-1 (SP-1046) Computer Interface Plug-In provides the interface between the Model 525 and either the Model 521 or the remote control unit. Selection of local operation with the Model 521 or remote operation with the remote control unit is accomplished by installing either the Model 9139 jumper plug in the Model 551-1 (SP-1046), for local operation or for remote operation, the Model 9140 Remote Input Cable is installed, which is connected to the remote control unit.

1.2.1 CONTROL OF RF OUTPUT FREQUENCY

In local operation, the Model 521 can select a single rf output frequency (CW mode, with sweep disabled), or either of the following types of linear frequency sweeps:

a. Wide. An up or down sweep is produced over all or any part of any single band. The start and stop frequencies are set by controls on the Model 521. Two frequency-calibrated markers are available.

b. Narrow. The center of the frequency sweep is set by a control on the Model 521. The extent of the symmetrical frequency excursion around the center frequency is set by another control. Two frequency-calibrated markers are avilable.

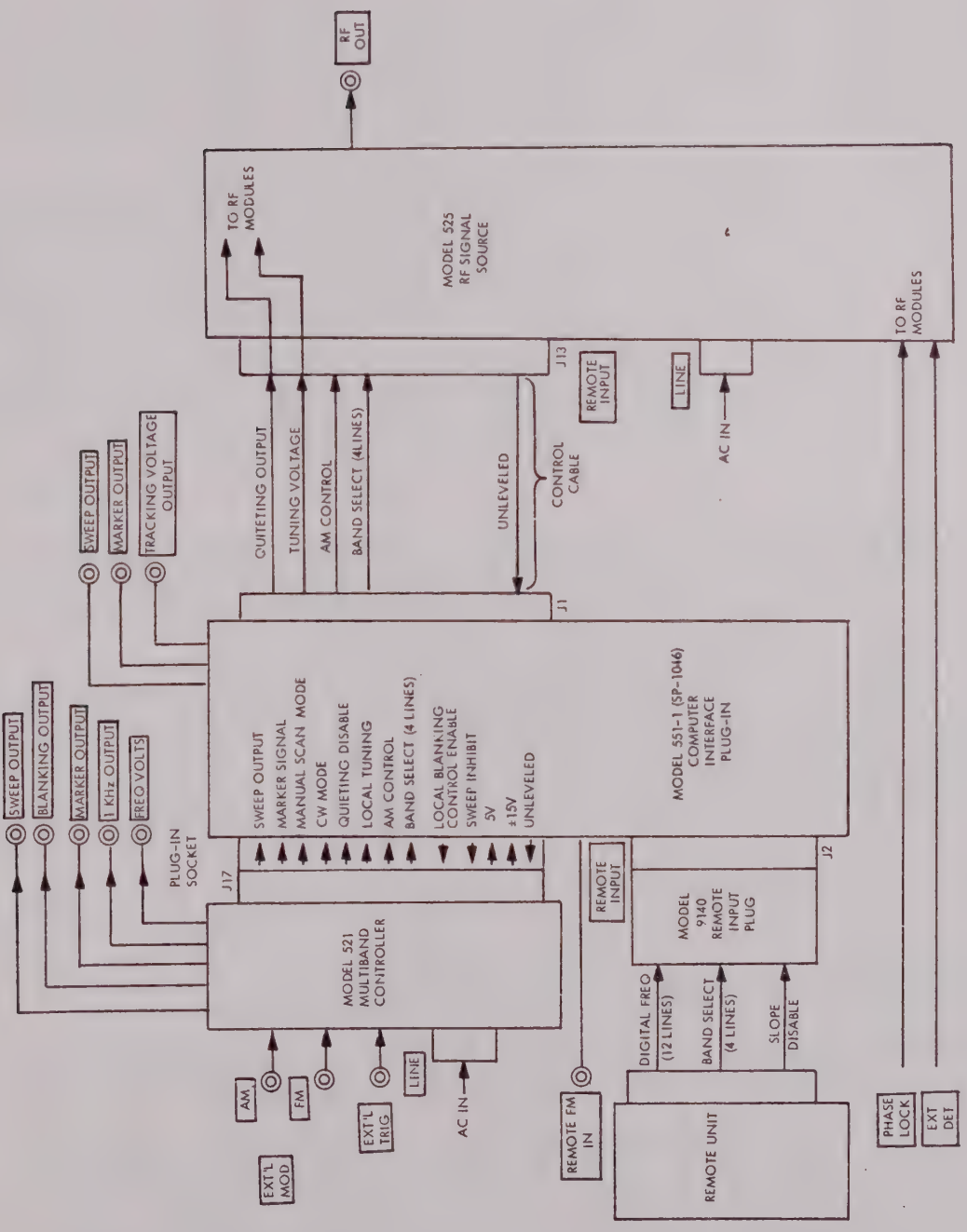


Figure 1-2. Model 50525 (SP-1048) System Block Diagram

The sweep speed in local operation is continuously variable from 10 milliseconds to 10 seconds by means of a 10:1 vernier. A manual scan mode can also be selected. The sweep output is made available to external equipment at output jacks on the Model 521 and the Model 551-1 (SP-1046).

In remote operation, the frequency sweep can be completely programmed by means of a remote control device to be a linear or non-linear function of time at any desired sweep rate. The frequency sweep can encompass more than one band. The frequency at each instant is determined by the value of a 12-bit (three BCD digits) digital input to the Model 551-1 (SP-1046), and also by 4 Band Select input lines.

In local operation, the sweep can be controlled or modified by an external frequency modulation (FM) input applied to the Model 521. In remote operation, the sweep can be controlled or modified by a remote FM input applied to the Model 551-1 (SP-1046). In both remote and local operation, vernier control of the output frequency can be accomplished by means of an external phase lock input applied to the Model 525. In both local and remote operation, a track-voltage output is available from the Model 551-1 (SP-1046). This output, calibrated at 1V/GHz, can be used for a digital voltmeter direct-reading display of the output frequency in GHz, or can be used for a frequency reference compatible with the Hewlett-Packard HP 8410B Network Analyzer.

1.2.2 CONTROL OF RF OUTPUT POWER LEVEL

In both remote and local operation, the power level of the rf output from the Model 525 is controlled by the Model 521. The rf output can be turned off during sweep retrace in local operation only.

A power control on the Model 521 sets the reference output power level. Either leveled or unleveled operation can be selected at the Model 525. When leveled operation is selected, the power is maintained at the reference level across the entire swept frequency range by means of a leveling circuit in the Model 525. This circuit utilizes the feedback from an internal or external crystal detector to maintain the power output at the level established by the Model 521, regardless of the output frequency.

The reference power level established by the Model 521 can be changed with respect to time or frequency as follows:

a. External AM. The output power level can be made a function of an external amplitude modulation (AM) input applied to the Model 521.

b. 1 KHz Modulation. A 1 KHz square wave oscillator within the Model 521 can be selected as the modulation source.

c. RF OFF. Turns off the rf output. Convenient for zeroing power meters and other monitoring devices.

d. Slope Control. A SLOPE control is provided on the Model 551-1 (SP-1046). Using this control, a slope in the rf output power level can be established, such that the power increases with increasing frequency. The slope control can be disabled during remote operation.

1.2.3 GENERATION OF MARKERS IN LOCAL MODE

In the local mode of operation, frequency-calibrated video markers are made available to external equipment at output jacks on the Model 521 and the Model 551-1 (SP-1046). The rf output can be controlled by the markers in either of the following marker modes:

a. Amplitude Markers. In this mode, the rf power level is reduced when the marker frequency is reached. The amount of attenuation is adjustable.

b. Intensity Markers. In this mode, the sweep is stopped momentarily at the marker frequency. On a CRT display, this produces a bright dot.

1.3 SPECIFICATIONS (figure 1-3 and tables 1-1 through 1-3)

Table 1-1 provides general specifications for the sweeper system. Detailed specifications for external inputs are given in figure 1-2, and detailed specifications for external outputs are given in table 1-3. The locations of the external input and output connectors are given in figure 1-3. Tables 1-2 and 1-3 identify the connectors by the index numbers in figure 1-3.

TABLE 1-1. GENERAL SPECIFICATIONS

ITEM NO.	PARAMETER	CHARACTERISTICS
1	Dimensions	Height 10.5 in; Width 16.75 in; Depth 16 in
2	Weight	Approximately 63 pounds
3	Environmental: A. Operating B. Non-Operating	 0 to +55 degrees C -55 to +85 degrees C
4	Input Power Requirements:	115/230 volts ± 10%, 50 to 60 Hz, single-phase, three-wire, 400 volt-amperes maximum.
5	Frequency Range	0.5 to 12.4 GHz in four bands, as follows:

Band	Frequency Range (GHz)
1	0.5 to 1.0
2	1.0 to 4.0
3	4.0 to 8.0
4	8.0 to 12.4

TABLE 1-1. GENERAL SPECIFICATIONS (Continued)

ITEM NO.	PARAMETER	CHARACTERISTICS
6	Range of Frequency Sweep	
	A. Remote Operation	0.5 to 12.4 GHz
	B. Local Operation	Single band (bands 1 to 4)
7	Multiband Sweep Display Discontinuity	Less than 3 milliseconds delay at band changeover. Fastest total sweep period is less than 30 milliseconds, including band changeovers.
8	Multiband Sweep Frequency Discontinuity	Frequency overlap at band changeover is factory set to be 0.25% of switching frequency.
9	Tuning Accuracy:	
	A. Local Operation	±1% of dial reading
	B. Remote Operation	±0.5% of frequency equivalent of digital value.
10	Sweep Modes (local operation):	
	A. CW	Full-range tuning to any desired frequency. Frequency vernier when pulled varies CW frequency by ±2.5% of the width of the selected band.
	B. Wide Sweep (F_1 - F_2)	Linear up or down sweep from F1 to F2 within any selected band, where F1 is the start frequency, and F2 is the stop frequency.
	C. Narrow Sweep ($F_c \pm \Delta F$)	Symmetrical, linear sweep around selected center frequency. Frequency vernier when pulled varies center frequency by ±2.5% of the width of the selected band. ΔF sets the excursion of the sweep.
11	Sweep Speeds (local operation)	10 milliseconds to 100 seconds in four switch-selectable ranges. Continuously variable between ranges by means of a 10:1 vernier control. Sweep speed accuracy is ±10%. Manual scan can also be selected.
12	Sweep Triggering Modes (local operation):	
	A. Internal	Free-running self-recurrent sweep
	B. Line	Sweep is synchronized to the ac line.
	C. External	Sweep is initiated by an external trigger input.
	D. Manual	Sweep is initiated by front panel pushbutton.

TABLE 1-1. GENERAL SPECIFICATIONS (Continued)

ITEM NO.	PARAMETER	CHARACTERISTICS
13	Frequency Markers (local operation):	
	A. Wide Sweep Mode	Individual controls are provided to set frequency of two markers at any point in the sweep range.
	B. Narrow Sweep Mode	A single control sets up two symmetrical markers equidistant from the center frequency of the sweep.
14	Marker Modes (local operation):	
	A. Amplitude Markers	The rf output power is attenuated at the marker frequency. Amount of attenuation is adjustable from 0 to -0.2 dB. Marker width is 1% of the width of the selected band. Marker accuracy is ±1% of dial reading.
	B. Intensity Markers	Sweep is momentarily stopped at marker frequency, producing a bright dot on a CRT display. Marker accuracy is ±1% of dial reading.
15	RF Output Power Control:	
	A. Unleveled	40 dB minimum range, uncalibrated.
	B. Leveled (internal or external)	0 to 10 milliwatts, calibrated, direct reading. Leveled power variation is ±1 dB maximum across the swept frequency range.
16	RF Output Power Modulation Modes (local or remote operation)	
	A. RF Off	Rf output is attenuated by 30 dB minimum.
	B. External AM	Rf output power is modulated by an external amplitude modulation input. The modulation is additive to the rf power setting in item 15. Sensitivity is .1V/MV in leveled operation. For unleveled operation a 10-volt peak-to-peak signal produces 100% modulation.
	C. Internal 1 KHz	Rf output power is modulated 100% by a 950 Hz to 1050 Hz square wave oscillator in the Model 521.

TABLE 1-1. GENERAL SPECIFICATIONS (Continued)

ITEM NO.	PARAMETER	CHARACTERISTICS
16	RF Output Power Modulation Modes (local or remote operation) (con't)	
	D. Frequency Slope Modulation	A SLOPE control on the Model 551-1 (SP-1046) provides adjustment of a positive-going slope of output power vs. frequency. That is, the power output increases with increasing frequency. The modulation is subtracted from the rf power setting in item 15, and any modulation in items 16B or 16C. The range of slope control is 30 dB minimum. Slope control can be disabled in remote operation.
	E. Retrace Blanking (local operation)	Rf output is turned off during sweep retrace.
17	Frequency Modulation A. Local Operation	External FM input modulates rf output frequency. Per volt sensitivity is 10% of the width of the selected band.
	B. Remote Operation	External FM input modulates rf output frequency. Per volt sensitivity is 2.45% of the width of the selected band. Accuracy is typically ±0.5% of the rf source frequency output.
18	Phase Lock Operation	Vernier control of rf output frequency is accomplished by an external phase lock input in either of the following modes: Wide: 10 MHz/volt (bands 2-4 only) Narrow: 150 KHz/mA
19	Undesired Responses (dB below full leveled output)	Bands: 1 / 2 (1 to 2.5 GHz) / 2 (2.5 to 4.0 GHz) / 3 / 4
	A. Harmonic Output	-20 dB / -16 dB / -20 dB / -20 dB / -30 dB
	B. Spurious, Non-Harmonic	-60 dB / -50 dB / -50 dB / -60 dB / -60 dB
20	Peak Residual FM	Less than 35 KHz. Typically 8 to 30 KHz, increasing with output frequency.

TABLE 1-1. GENERAL SPECIFICATIONS (Continued)

ITEM NO.	PARAMETER	CHARACTERISTICS
21	Residual AM	Less than 40 dB. Typically less than 50 dB. depending on leveling mode and leveled output setting.
22	Digital-to-Analog Frequency Conversion (remote operation):	
	A. Digital Input	12 bits (3 binary coded decimal (BCD) digits)
	B. Range of Digital Input Values	Effective BCD range is 010 to 990.
	C. Analog Conversion (tuning voltage)	Voltage = 0.01 x BCD value of digital input
	D. Conversion Accuracy	±½ LSB.
	E. Frequency Resolution	980 discrete frequencies within each band
23	Quieting Control (local operation)	In CW sweep mode or manual scan mode, the tuning bandwidth is reduced, thereby reducing incidental noise and residual FM in the rf output.

TABLE 1-2. EXTERNAL INPUTS

INDEX NO. (fig. 1-3)	CONNECTOR LABEL	LOCATION	CHARACTERISTICS
1	EXT'L MOD AM	Rear of Model 521	See item 16B of table 1-1. Input Impedance: 100K. Bandwidth: DC to 10 KHz
2	EXT'L MOD FM	Rear of Model 521	See item 17A of table 1-1. Input Impedance: 24K
3	EXT'L TRIG	Rear of Model 521	See item 12C of table 1-1 Amplitude: +4 volts peak (nominal)
4	REMOTE FM IN	Rear of Model 551-1 (SP-1046)	See item 17B of table 1-1. Bandwidth: DC to 10 KHz

TABLE 1-2. EXTERNAL INPUTS (Continued)

INDEX NO. (fig. 1-3)	CONNECTOR LABEL	LOCATION	CHARACTERISTICS
5	REMOTE INPUT from remote control unit:	Rear of Model 551-1 (SP-1046)	
	A. Band Select		Four lines to select bands 1 through 4. TTL compatible, low true.
	B. Digital Frequency		12 lines (three BCD digits). TTL compatible.
	C. Slope Disable		One line. TT1 compatible. 0 volts disables slope control.
6	PHASE LOCK	Rear of Model 525	See item 18 of table 1-1

Parameter	Wide Mode	Narrow Mode
Bandwidth (without quieting)	DC to 70 KHz (bands 2-4 only)	DC to 5 KHz (band 1) DC to 1 KHz (bands 2-4)
Bandwidth (with quieting)	DC to 50 Hz	DC to 50 Hz

7	EXT DET	Rear of Model 525	Output from external positive or negative-going crystal detector or power meter.
8	LINE	Rear of Model 521	115/230V, single-phase, 50 to 60 Hz, three-wire, 100 volt-amperes maximum.
9	LINE	Rear of Model 525	115/230V, single-phase, 50 to 60 Hz, three-wire, 300 volt-amperes maximum.

TABLE 1-3. EXTERNAL OUTPUTS

INDEX NO. (fig. 1-3)	CONNECTOR LABEL	LOCATION	CHARACTERISTICS
10	SWEEP OUTPUT	Rear of Model 521	Positive ramp sweeps (0 to +10 volts) Output impedance is less than 100 ohms. Local operation only.
11	SWEEP OUTPUT	Front panel of Model 551-1 (SP-1046)	Same characteristics as Index No. 10. Local operation only.
12	MARKER OUTPUT	Rear of Model 521	-1-volt pulse coincident with each frequency marker during sweep. Output impedance is nominally 3K. Local operation only.
13	MARKER OUTPUT	Front panel of Model 551-1 (SP-1046)	Same characteristics as Index No. 12. Local operation only.
14	FREQ./VOLTS	Rear of Model 521	Negative reference voltage (0 to -10.0 volts full-scale) proportional to rf output frequency. -0.1V is lowest usable frequency, and -9.9V is highest usable frequency. Local operation only.
15	BLANKING OUTPUT	Rear of Model 521	+14 volts during sweep retrace: 0 volts during sweep. Output impedance is 1K maximum. Local operation only.
16	1 KHZ OUTPUT	Rear of Model 521	950 to 1050-Hz square wave output. TTL compatible. Local and remote operation.
17	TRACKING VOLTAGE OUTPUT	Rear of Model 551-1 (SP-1046)	Positive reference voltage proportional to frequency. Calibrated at 1V/GHz. Accuracy is ±0.5%. Output impedance is less than 100 ohms. Local and remote operation.
18	RF OUT	Rear of Model 525	See items 6, 7, 8, 14, 15, 16, 17, 18, 19, 20, and 21 of table 1-1 for characteristics. Local and remote operation.

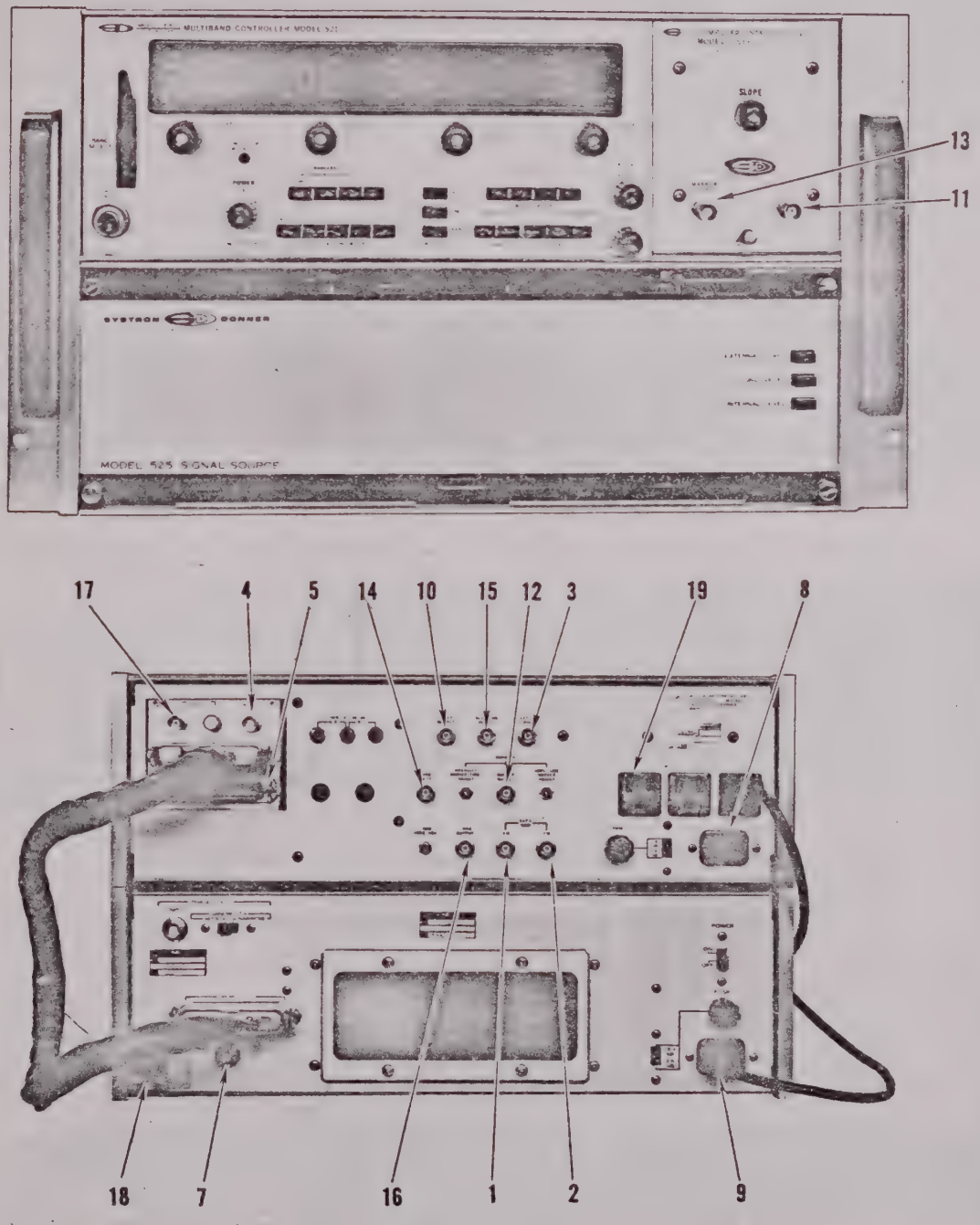


Figure 1-3. External Input and Output Connections

TABLE 1-3. EXTERNAL OUTPUTS (Continued)

INDEX NO. (fig. 1-3)	CONNECTOR LABEL	LOCATION	CHARACTERISTICS
19	SWITCHED LINE OUTPUTS (3 connectors)	Rear of Model 521	115/230V, single-phase, 50 to 60 Hz three-wire power is present at these connectors when power to the Model 521 is switched on at the front panel. Maximum power drain is 700 volt-amperes.

1.4 PHYSICAL DESCRIPTION (figure 1-1)

The Model 521 chassis includes the compartment into which the Model 551-1 (SP-1046) is installed. The Model 551-1 (SP-1046) slides into this compartment, and an interface connector on the unit mates with a connector on the Model 521 chassis. A lock knob on the Model 551-1 (SP-1046) must be turned clockwise to lock the unit in place. A Model 9009 Rack Mount Adapter accommodates both the Model 521 and the Model 525. All external connections, and all interconnections between the three units, are made at the rear panel.

1.4.1 MODEL 521

The front panel of this unit contains the linear slide rule dial which displays the frequency scale for the band selected by the BAND selector lever. The controls which set up the frequency sweep parameters are located immediately below the dial. The main power switch is located at the bottom left side. Controls for setting the rf output power level, the marker mode, the modulation mode, the sweep triggering mode, the sweep mode, and the sweep time are also provided on the front panel. All electrical components, other than those mounted to the front panel, are contained on five subassemblies, as follows:

- A1 - Power Supply Subassembly
- A2 - Sweep Generator Printed Circuit Board
- A3 - Mode Generator Printed Circuit Board
- A4 - Marker Generator Printed Circuit Board
- A5 - Amplitude Modulation Printed Circuit Board

The rear panel of the unit contains BNC connectors for external inputs and outputs, the main power fuse, the line voltage selector switch, and the connector for the ac power input. Also provided are three ac convenience outlets which provide ac power to ancillary equipment when power to the Model 521 is switched on.

1.4.2 MODEL 551-1 (SP-1046)

This unit receives all of its dc operating voltages from the Model 521, thus no power supplies are included in the unit. All electronic componts except the front-panel SLOPE control are mounted on two printed circuit boards (A1 and A2). The front panel also contains the BNC connectors for marker and sweep outputs from the Model 521. The rear panel contains the plug-in connector that mates with the connector on the Model 521, and the connectors that interface the unit with the Model 525 and the remote control unit.

1.4.3 MODEL 525

The Model 525 is independently powered from the ac line. The front panel contains three pushbutton switches used to select the leveling mode. The rear panel contains the ac line connector, the power switch, the line voltage selector switch, the main power fuse, and the input and output signal connectors. Mounted within the chassis are the power transformer, pass transistor board,(A4), and power supply regulator board (A5) that form the power supply for the unit. Two printed circuit boards, Leveling Control Board (A3) and AM Board (A2), provide the interface between the Model 551-1 (SP-1046) and the four rf modules, and include the leveling control circuits. The four rf modules are assigned as follows:

Module No.	Frequency Band
1	4 (8 to 12.4 GHz)
2	2 (1 to 4 GHz)
3	3 (4 to 8 GHz)
4	1 (0.5 to 1 GHz)

The rf outputs from the four rf modules are supplied to an rf switch, which selects the output from the module selected by the Model 551-1 (SP-1046). The selected rf output is supplied through a directional coupler to the RF OUT connector on the rear panel.

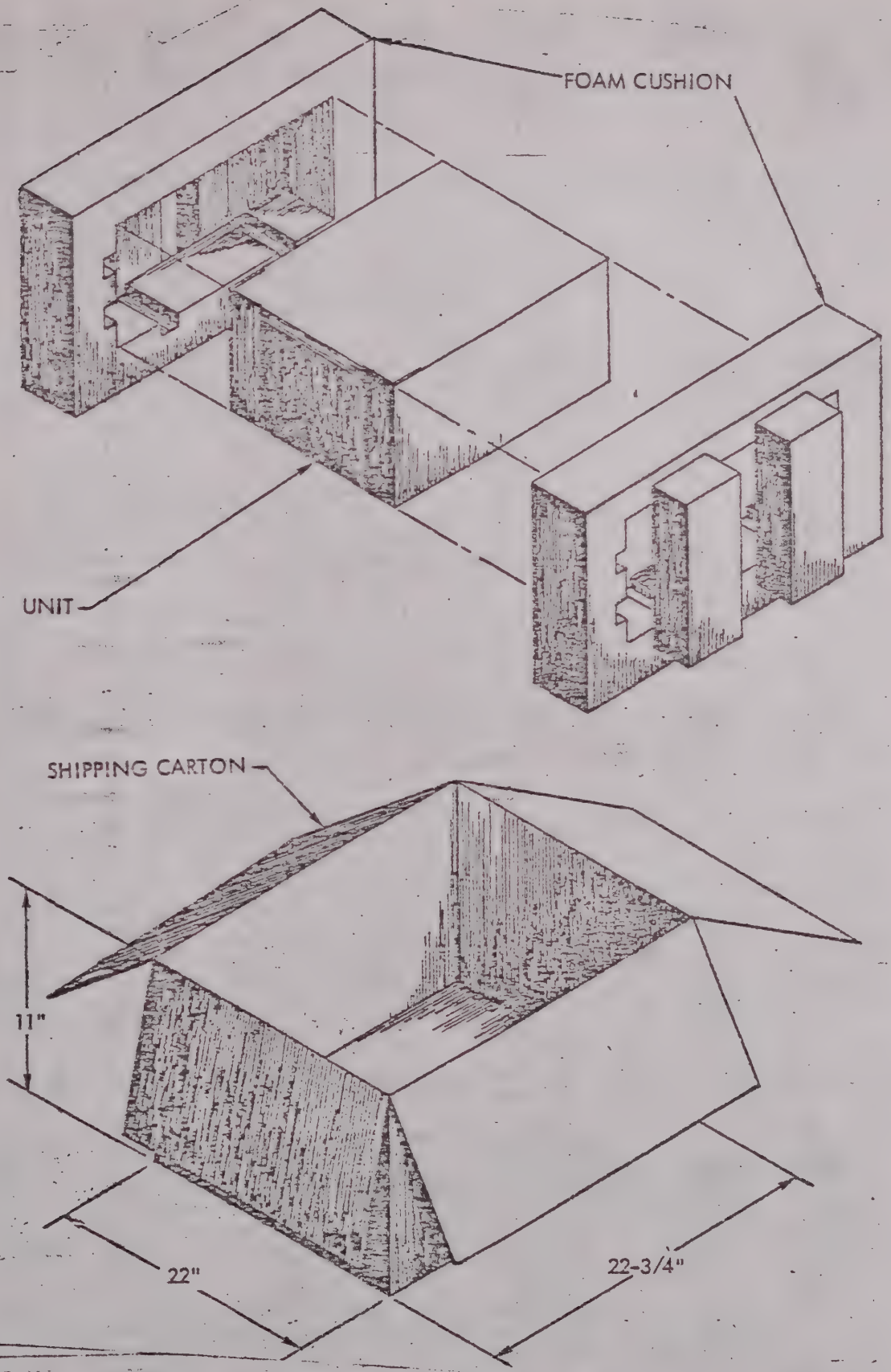


Figure 2-1. Packaging for Shipment

SECTION II

UNPACKING, INSTALLATION, AND RESHIPMENT

2.1 UNPACKING AND INSPECTION (figure 2-1)

The unit is shipped in a specially constructed container, shown in figure 2-1. This container provides maximum protection for the unit during transit. Use care when unpacking to prevent damage to the equipment. Save the original container for reshipment.

2.1.1 REMOVING UNIT FROM SHIPPING CONTAINER

To remove the unit from the shipping container, cut and fold back the outer carton top flaps, remove the top protective cushion, and lift the unit clear of the container. Then, open the dust protection bag, and remove the unit from the bag.

2.1.2 INSPECTION

The unit was carefully tested and inspected prior to shipment. Inspect the unit for any damage in shipment. Verify that all required cables are included.

2.2 INSTALLATION (figure 2-2)

To install the unit, refer to figure 2-2, and perform the following steps:

Step 1. Mount the unit according to the specific requirements of your installation.

Step 2. If Model 551-1 (SP-1046) plug-in is not installed in the Model 521, slide the plug-in into the compartment in the Model 521 with the front panel lock knob of the plug-in turned fully counter-clockwise. Make sure that wire loops on the plug-in rear panel connector are out of the way, and gently insert the plug-in connector into the mating connector of the Model 521. DO NOT FORCE. When plug-in is fully inserted, turn the front panel lock knob of the plug-in clockwise until it is tight.

Step 3. Connect the supplied cable (figure 2-3) from the REMOTE OUTPUT connector (1, figure 2-2) of the Model 551-1 (SP-1046) to the REMOTE INPUT connector (2, figure 2-2) on the Model 525.

Step 4. Assure that the PUSH ON-OFF button (3, figure 2-2) on the Model 521 is out (off).

Step 5. Determine the voltage (115 volts or 230 volts) of the ac power source. On the Model 521, set the line voltage selector switch (4, figure 2-2) to correspond to the ac line voltage. On the Model 525, set the line voltage selector switch (5, figure 2-2) to correspond to the ac line voltage.

Step 6. Assure that the correct fuses are installed in the Model 521 (6, figure 2-2) and the Model 525 (6, figure 2-2), as follows:

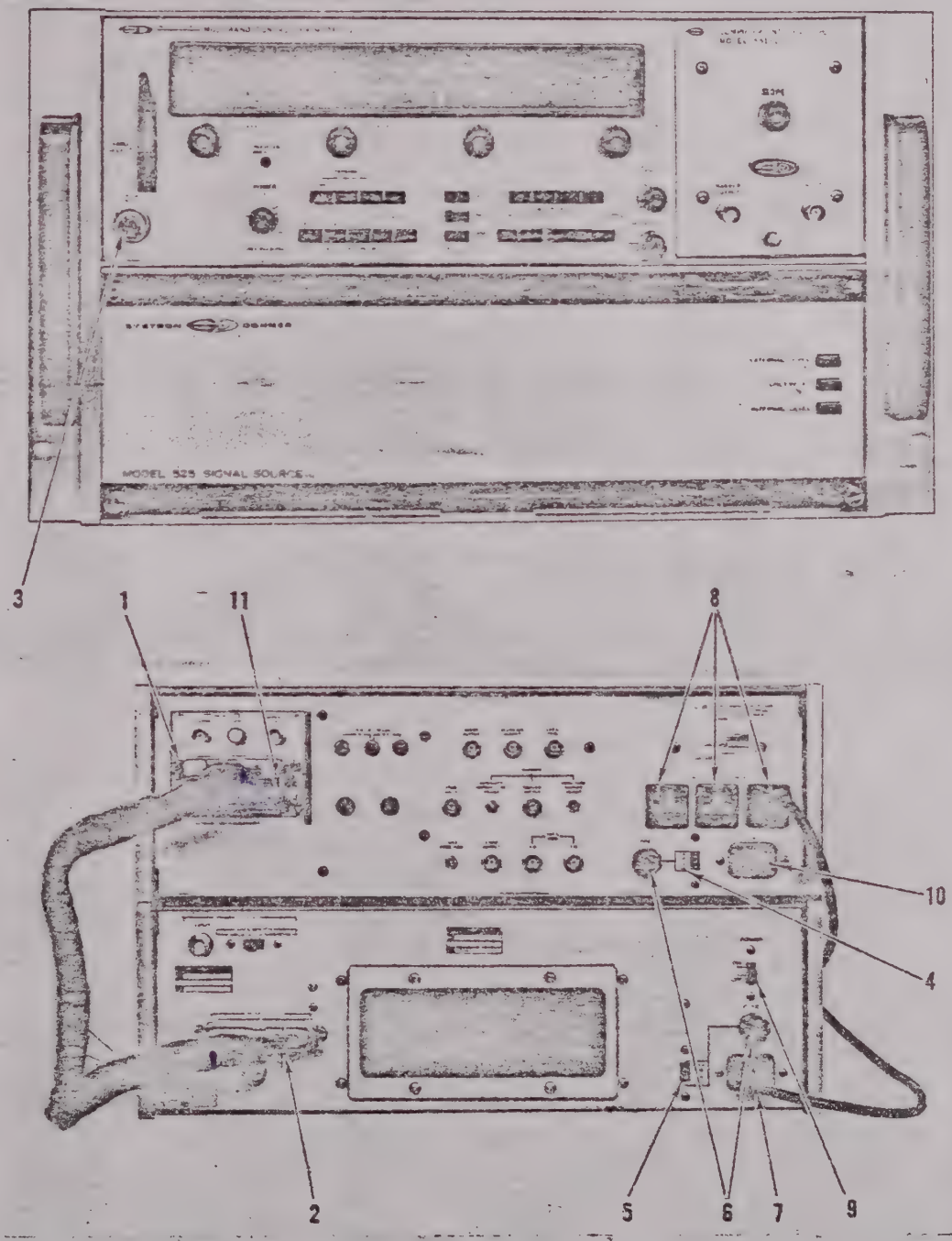


Figure 2-2. Installation

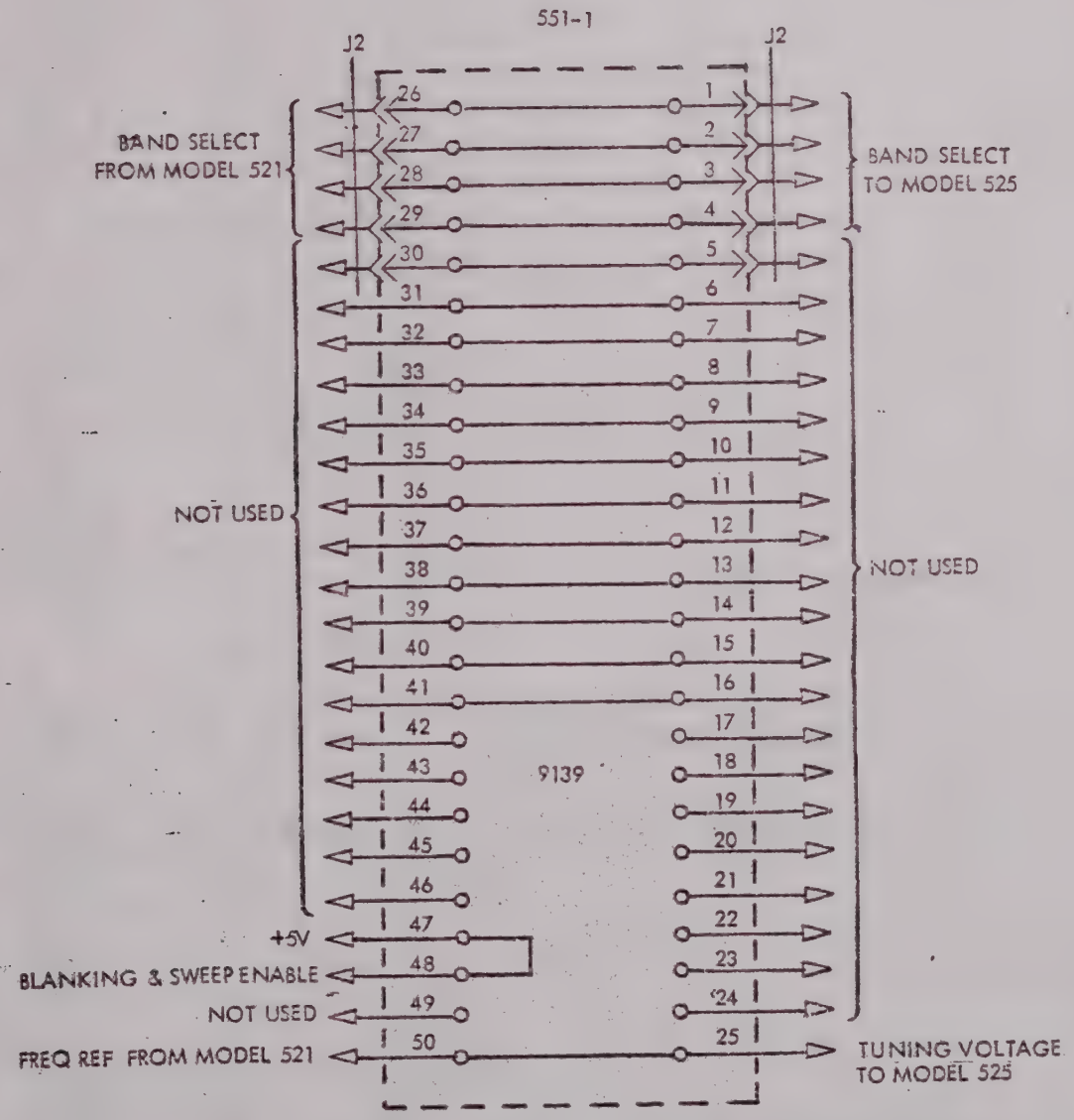


Figure 2-4. Model 9139 Jumper Plug Schematic

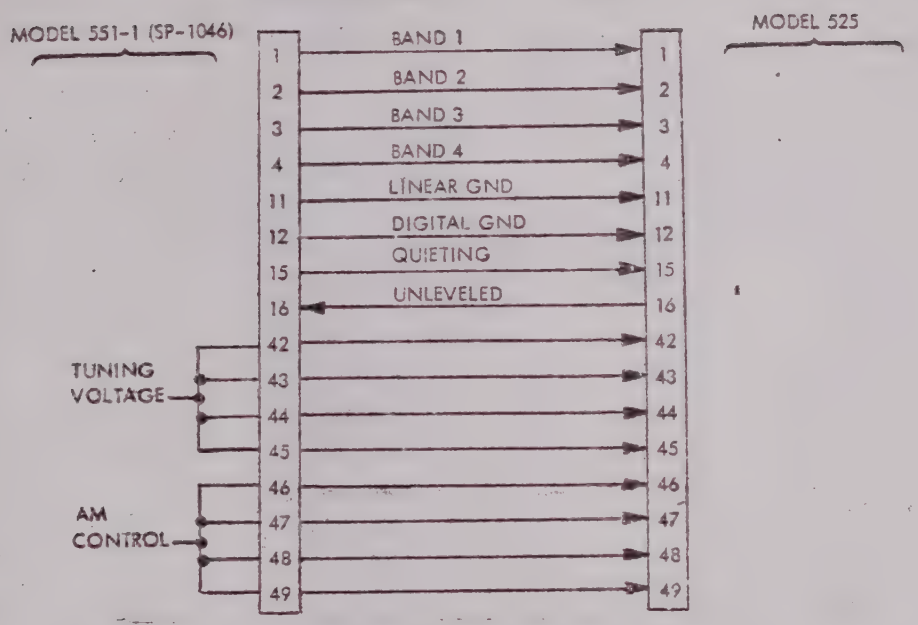


Figure 2-3. Control Cable from Model 551(SP-1046) to Model 525

AC Line Voltage	Fuse	
	Model 521	Model 525
115 volts	1 amp Slo-Blo	3 amp Slo-Blo
230 volts	½ amp Slo-Blo	1.5 amp Slo-Blo

Step 7. Connect a power cable from the LINE connector (7, figure 2-2) of the Model 525 to one of the three SWITCHED LINE OUTPUTS connectors (8, figure 2-2) on the Model 521.

Step 8. Set the POWER ON/OFF switch (9, figure 2-2) on the Model 525 to ON.

Step 9. Connect a power cable from the LINE connector (10, figure 2-2) on the Model 521 to the ac power source.

Step 10. If unit is to be operated in local mode, install the Model 9139 jumper plug (figure 2-4) in the REMOTE INPUT connector (11, figure 2-2) of the Model 551-1 (SP-1046). If the unit is to be operated in remote mode, install the Model 9140 Remote Input Plug (figure 2-5) in the REMOTE INPUT connector, and then connect the required cable from the remote control unit to the Model 9140 Remote Input Plug.

Step 11. Press the PUSH ON-OFF button (3, figure 2-2) to apply power to the system. The indicator light in the button shall go on.

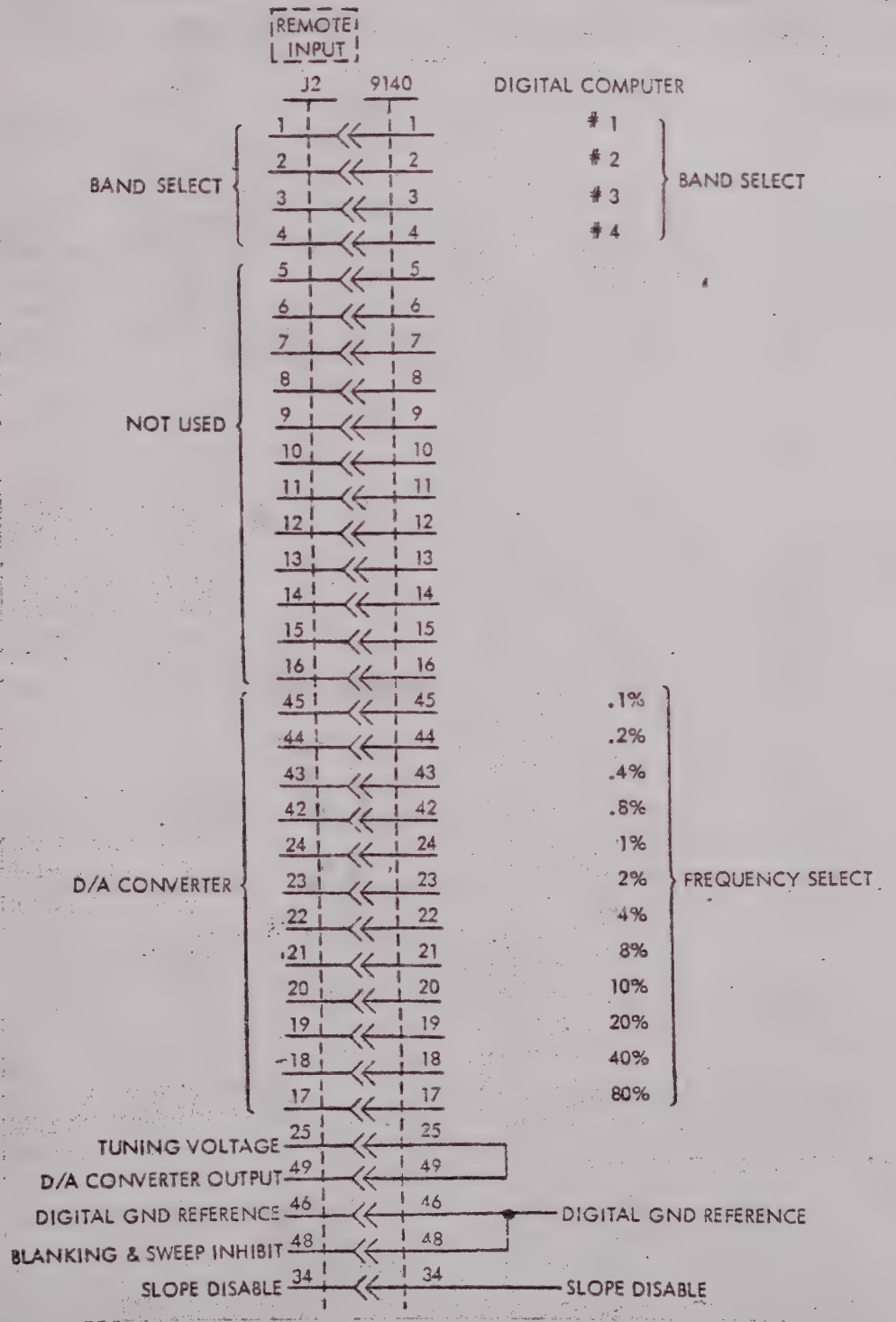


Figure 2-5. Model 9140 Remote Input Plug Schematic

Step 12. Refer to Section 3, Operation, for operating instructions.

2.3 PACKAGING FOR RESHIPMENT

Use the original shipping container (see figure 2-1) for reshipment. Proceed as follows:

Step 1. Wrap the unit in heavy wrapping paper or plastic protective covering.

Step 2. Place a protective cushion in the bottom of the shipping container, and place the unit on the cushion. Install the top protective cushion on the unit. Assure that unit is completely surrounded by protective cushions.

Step 3. Seal the shipping container.

SECTION III

OPERATION

3.1 GENERAL (figure 3-1)

Figure 3-1 provides front and rear views of the equipment, with indexed call-outs for all operating controls. All input and output connectors are described in tables 1-2 (inputs) and 1-3 (outputs). These connectors are illustrated in figure 1-3. Tables 3-1 through 3-3 list and describe the controls identified in figure 3-1.

TABLE 3-1. AC POWER CONTROLS

INDEX NO. (fig. 3-1)	CONTROL LABEL & DESCRIPTION	LOCATION	FUNCTION
1	115/230V selector switch	Rear of Model 521	Must be set to correspond to the ac line voltage being utilized.
2	115/230V selector switch	Rear of Model 525	Must be set to correspond to the ac line voltage being utilized.
3	FUSE	Rear of Model 521	Provides protection for ac line input to Model 521.
4	FUSE	Rear of Model 525	Provides protection for ac line input to Model 525.
5	POWER ON/OFF switch	Rear of Model 525	Applies line power to dc power supplies in Model 525.
6	PUSH ON-OFF pushbutton switch/indicator	Front panel of Model 521	Applies line power to dc power supplies in Model 521, and to SWITCHED LINE OUTPUTS connectors on rear panel of Model 521. When power is applied, the indicator in the control is lighted.

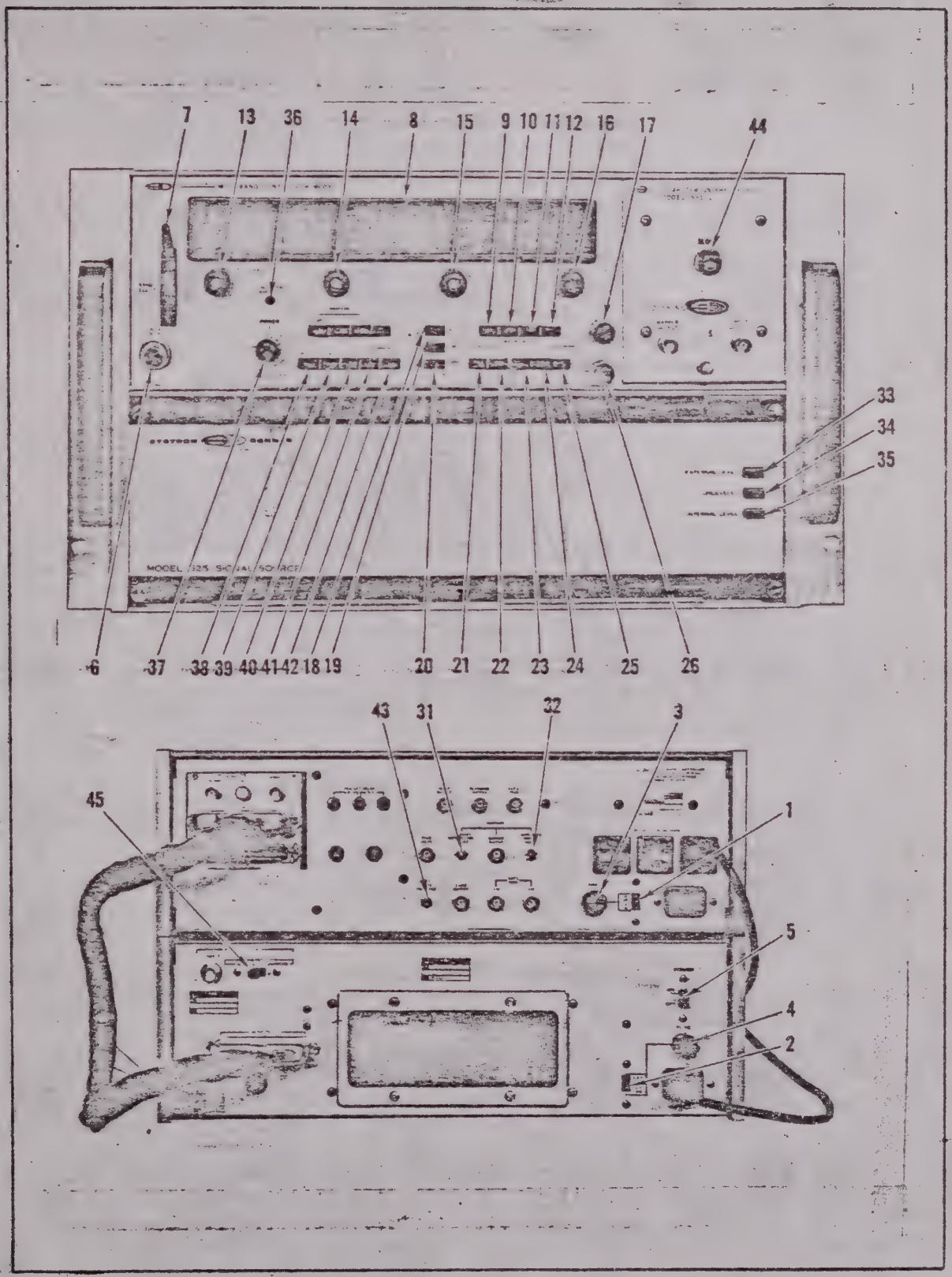


Figure 3-1. Operator Controls and Indicators

TABLE 3-2. SWEEP PARAMETER AND MARKER CONTROLS
(Local Operation Only)

INDEX NO. (fig. 3-1)	CONTROL LABEL & DESCRIPTION	LOCATION	FUNCTION
7	BAND SELECT lever	Front panel of Model 521	Selects frequency band in local operation. Selects the scale which appears in the frequency dial window.
8	Frequency slide-rule dial	Front panel of Model 521	Scale is selected by BAND SELECT lever. Upper scale displays the frequencies within the selected band. Lower scale displays relative frequency within the selected band.
	SWEEP MODE interlocked pushbutton switches:	Front panel of Model 521	Select sweep mode
9	F1-F2		Selects wide sweep mode. The sweep is set up by the F1-START and F2-STOP controls on upper frequency scale.
10	Fc ± ΔF X1		Selects narrow sweep mode, in which center frequency, Fc, is read from upper frequency scale, and frequency excursion, ΔF, is read directly from lower frequency scale. The sweep is set up by the MARKER 1 - Fc/CW, F2-STOP -ΔF, and ΔF/CW VERNIER controls.
11	Fc ± ΔF X.1		Selects narrow sweep mode, in which center frequency, Fc, is read from upper frequency scale, and frequency excursion, ΔF, on lower frequency scale must be multiplied by 0.1. The sweep is set up by the MARKER 1 - Fc/CW, F2-STOP -ΔF, and ΔF/CW VERNIER controls.

TABLE 3-2. SWEEP PARAMETER AND MARKER CONTROLS
(Local Operation Only) (Con't)

INDEX NO. (fig. 3-1	CONTROL LABEL & DESCRIPTION	LOCATION	FUNCTION
12	CW		In this mode, the sweep is disabled, and the rf output is constant in frequency. A quieting circuit is enabled, which reduces incidental noise and residual FM in the rf output. The frequency is determined by the MARKER 1 - Fc/CW and ΔF/CW VERNIER controls.
	Frequency dial controls:	Front panel of Model 521	Set up sweep parameters and marker frequencies. Color of control matches color of dial pointer that is positioned by the control.
13	F1-START		Sets start-of-sweep frequency in wide sweep mode.
14	MARKER 1 - Fc/CW		Sets rf output frequency in CW sweep mode. Sets center frequency, Fc, in narrow sweep modes. Sets frequency of marker 1 in wide sweep mode.
15	MARKER 2 - SYM ΔF MARKER		Sets frequency of marker 2 in wide sweep mode. Sets frequency of symmetrical markers in narrow sweep modes.
16	F2-STOP - ΔF		Sets end-of-sweep frequency in wide sweep mode. Sets width of symmetrical sweep in narrow sweep modes.
17	ΔF/CW VERNIER control	Front panel of Model 521	In OFF position, vernier control is disabled. When switched to on in the CW or narrow scan mode, the control provides an electrical vernier for the frequency set by the Fc/CW control. The total range of the control is ±2.5% of the width of the selected band.

TABLE 3-2. SWEEP PARAMTER AND MARKER CONTROLS
(Local Operation Only) (Con't)

INDEX NO. (fig. 3-1)	CONTROL LABEL & DESCRIPTION	LOCATION	FUNCTION
	TRIGGER interlocked push-button switches:	Front panel of Model 521	Select sweep triggering mode in wide and narrow sweep modes.
18	INT		When depressed, free-running, self-recurrent sweep triggering is selected.
19	LINE		When depressed, the start of each sweep is synchronized with the ac line frequency.
20	MAN/EXT		When depressed the external trigger mode is selected, and the sweep is triggered by an external input to the EXT'L TRIG connector. Pressing this momentary button if no external trigger signal is applied initiates a single sweep.
	SWEEP TIME (SECONDS) interlocked pushbutton switches	Front panel of Model 521	In conjunction with the sweep time VERNIER control, selects the duration of the sweeps produced in the wide and narrow sweep modes. The initial sweep delay is 3 milliseconds.
21	.01		Sweep time is variable from 10 milliseconds to 100 milliseconds. Sweep retrace time is 1 millisecond.
22	.1		Sweep time is variable from 100 milliseconds to 1000 milliseconds. Sweep retrace time is 10 milliseconds.
23	1		Sweep time is variable from 1 second to 10 seconds. An end-of-sweep delay of 60 milliseconds is incorporated. Sweep retrace time is .1 second.

TABLE 3-2. SWEEP PARAMETER AND MARKER CONTROLS
(Local Operation Only) (Con't)

INDEX NO. (fig. 3-1)	CONTROL LABEL & DESCRIPTION	LOCATION	FUNCTION
24	10		Sweep time is variable from 10 seconds to 100 seconds. An end-of-sweep delay of 60 milliseconds is incorporated. Sweep retrace time is 1 second.
25	MANUAL SCAN		Pressing this button disables the sweep, and permits the sweep time VERNIER control to manually control the sweep output over the swept frequency range. A quieting circuit is enabled, which reduces incidental noise and residual FM in the rf output.
26	Sweep Time VERNIER control	Front panel of Model 521	In MANUAL SCAN mode, the sweep is manually controlled by turning the VERNIER control. In other sweep time mode, this control is used to set the sweep time within the selected range. With the control set to X1, the sweep time in seconds corresponds to the label on the SWEEP TIME button that has been pressed. With the control set to X10, the sweep time in seconds is ten times the label on the button that has been pressed.
	MARKERS interlocked pushbutton switches	Front panel of Model 521	Select the marker mode.
27	AMPL		Causes rf output to be attenuated when sweep passes through marker frequency. Amount of attenuation is set by rear panel AMPLITUDE MARKER ADJUST control.
28	OFF		Disables all internal markers. Marker pulse is still available at MARKER OUTPUT connectors.

TABLE 3-2. SWEEP PARAMETER AND MARKER CONTROLS
(Local Operation Only) (Con't)

INDEX NO. (fig. 3-1)	CONTROL LABEL & DESCRIPTION	LOCATION	FUNCTION
29	INTEN		Causes sweep to be stopped momentarily at marker frequency. The time duration of the sweep pause is adjustable by means of the rear panel INTENSITY MARKER TIME ADJUST control.
30	RETRACE push-button switch	Front panel of Model 521	When button is out, the rf output is turned off during sweep retrace. When button is pressed, rf output remains on during retrace. BLANKING OUTPUT is available at all times.
31	INTENSITY MARKER TIME ADJUST screwdriver adjustment	Rear of Model 521	Adjusts stop time of sweep in intensity marker mode.
32	AMPLITUDE MARKER ADJUST screwdriver adjustment	Rear of Model 521	Adjusts the amount of rf output attenuation at marker frequency.

TABLE 3-3. RF OUTPUT POWER AND MODULATION CONTROLS

INDEX NO. (fig. 3-1)	CONTROL LABLE & DESCRIPTION	LOCATION	FUNCTION
	Leveling mode interlocked pushbutton switches:	Front panel of Model 525	Select leveling mode for rf output.
33	EXTERNAL LEVEL		Selects external leveling, using the input to the EXT DET connector on the rear of the Model 525.
34	UNLEVELED		Selects unleveled operation. Causes UNLEVELED WHEN LIT indicator on Model 521 front panel to illuminate.

TABLE 3-3. RF OUTPUT POWER AND MODULATION CONTROLS (Con't)

INDEX NO. (fig. 3-1)	CONTROL LABLE & DESCRIPTION	LOCATION	FUNCTION
35	INTERNAL LEVEL		Selects internal leveling, which utilizes the output from a crystal detector within the Model 525.
36	UNLEVELED WHEN LIT indicator	Front panel of Model 521	Illuminates when UNLEVELED operation is selected at the Model 521 or 525 when unleveled in the leveled mode.
37	POWER control	Front Panel of Model 521	When pushed in, sets the rf output power level. Calibrated from 0 to 10 mW. We When UNLEVELED WHEN LIT indicator is lighted, the POWER button is pulled out, and provides an uncalibrated range of 40 dB.
	MODULATION MODE pushbutton switches:	Front panel of Model 521	Select modulation mode for rf output.
38	RF-OFF		Turns off the rf output.
39	CW		Removes all amplitude modulation on rf output.
40	1 KHz		Turns on the internal 1 KHz square wave modulator, which produces 100% modulation of the rf output. Frequency is adjustable by means of rear panel 1 KHz FREQ ADJ control.
41	EXT AM		Selects input to rear panel EXT'L MOD AM connector as the source of amplitude modulation, which is additive with the power setting of the POWER control.
42	EXT FM		Selects input to rear panel EXT'L MOD FM connector as the frequency modulation signal source during local operation.

TABLE 3-3. RF OUTPUT POWER AND MODULATION CONTROLS (Con't)

INDEX NO. (fig. 3-1)	CONTROL LABEL & DESCRIPTION	LOCATION	FUNCTION
43	1 KHZ FREQ ADJ screwdriver adjustment	Rear of Model 521	Adjusts frequency of 1 KHz square wave modulator in Model 521. Adjustment range is 950 to 1050 Hz.
44	SLOPE control	Front panel of Model 551-1 (SP-1046)	Provides for adjustment of positive-going slope of rf power output vs frequency. Turning the control fully counterclockwise produces a zero slope. Turning the control fully clockwise provides a minimum power difference of 30 dB between the rf power output at the bottom of band 1 and the top of band 4. The slope control can be disabled in remote operation.
45	PHASE LOCK BANDWIDTH selector switch	Rear of Model 525	Selects wide or narrow bandwidth operation for input to PHASE LOCK connector on rear of Model 525.

3.2 OPERATING PROCEDURE

Step 1. Perform the procedure in paragraph 2.2 to prepare the unit for use.

Step 2. If system was set up to operate in local mode in step 1, proceed to step 3. If system was set up to operate in remote mode, proceed to step 8.

Step 3. Refer to table 3-2, and select sweep mode by depressing the appropriate SWEEP MODE button. Select desired band with BAND SELECT lever. Then, set sweep parameter controls according to selected sweep mode, as shown in table 3-4.

Step 4. Refer to table 3-2, and select the desired sweep speed by depressing the appropriate SWEEP TIME (SECONDS) button. The sweep time VERNIER control can be operated to adjust to any desired sweep time between ranges if .01, .1, 1, or 10 button was pressed.

Step 5. Refer to table 3-2, and select the desired triggering mode by depressing the appropriate TRIGGER button. If external triggering was selected, apply an input signal having the characteristics of item 5 of table 1-2 to the EXT'L TRIG connector on the rear of the Model 521.

TABLE 3-4. SWEEP PARAMETER CONTROL SETTINGS

SWEEP MODE	F1-START	MARKER 1 - Fc/CW	MARKER 2 - SYMΔF MARKERS	F2-STOP-ΔF	ΔF/CW VERNIER
CW	Not used	Desired freq. on upper scale	Not used	Not used	Fine freq. adust
F1-F2	Start Freq. on upper scale	Marker 1 freq. on upper scale	Marker 2 freq. on upper scale	Stop Freq. on upper scale	Not used
$F_c \pm \Delta F$ X1	Not used	Desired center freq. on upper scale	Relative freq. of symmetrical markers on lower scale	Freq. Excursion on lower scale	Fine adjust of center freq.
$F_c \pm \Delta F$ X.1	Not used	Desired center freq. on upper scale	Relative freq. of symmetrical markers on lower scale	10 times freq. excursion on lower scale.	Fine adjust or center freq.

Step 6. Refer to table 3-2, and select the desired marker mode by depressing the appropriate MARKERS button.

Step 7. If retrace blanking of rf output is desired, pull out the RETRACE button.

Step 8. Refer to table 3-3, and set up rf modulation parameters, as follows:

a. Select the desired modulation mode by depressing the appropriate MODULATION MODE button(s). If EXT AM modulation is selected,apply an input signal having the characteristics in item 1 of table 1-2 to the EXT'L MOD AM connector on the rear of the Model 521. If EXT FM modulation is selected (local operation only), apply an input signal having the characteristics of item 2 in table 1-2 to the EXT'L MOD FM connector on the rear of the Model 521.

b. Set SLOPE control for desired power vs. frequency slope. If a zero slope is desired, set the SLOPE control fully counterclockwise.

Step 9. Refer to table 3-3, and select desired leveling mode by depressing the appropriate button on the front panel of the Model 525. If UNLEVELED button was pressed, the UNLEVELED WHEN LIT light shall go on. If external leveling is selected, connect an input signal having the characteristics of item 7 of table 1-2 to the EXT DET connector on the rear of the Model 525.

Step 10. Connect a cable from the RF OUT connector of the Model 525 to the unit under test.

Step 11. If unleveled operation was selected in step 9, refer to table 3-3, and pull out the POWER control on the Model 521; otherwise, push in the POWER control. Adjust the POWER control for the desired rf output power level.

Step 12. If phase lock operation is desired, refer to table 3-3, and select the desired phase lock mode with the PHASE LOCK BANDWIDTH switch on the rear of the Model 525. Apply an input signal having the characteristics of item 6 of table 1-2 to the PHASE LOCK connector on the rear of the Model 525.

Step 13. If system is being operated in the remote mode, and if external FM modulation is desired, apply an input signal having the charactersitics of item 4 of table 1-2 to the REMOTE FM IN connector on the rear of the Model 551-1 (SP-1046).

Step 14. Utilize the outputs in items 10 through 17 of table 1-3 in any desired manner by making the connections to the appropriate connectors.

SECTION IV

FUNCTIONAL OPERATION CHECKS

4.1 GENERAL

This section contains functional operation checks, which provide the user with general indications that the sweeper system is operating normally. Refer to Section VI for detailed minimum performance checks.

4.2 LOCAL OPERATION CHECKS

Prepare the system for local operation by performing the procedure in paragraph 2.2. Then, proceed as follows:

Step 1. Connect a power meter to the RF OUT connector.

Step 2. Make the following control settings:

Control	Setting
BAND SELECT	1
SWEEP MODE	F1-F2
F1-START	0.5 GHz
F2-STOP	1.0 GHz
SWEEP TIME	MANUAL SCAN
TRIGGER	INT
MARKERS	OFF
SWEEP TIME VERNIER	X1
RETRACE	Out
MODULATION MODE	CW (EXT FM pulled out)
POWER	Pushed in and set to 5 mW
INTERNAL LEVEL	Depressed
SLOPE	Fully counterclockwise

Step 3. Set up the power meter for 10 mW full sweep.

Step 4. Slowly turn the sweep time VERNIER control from X1 to X10 while observing the P.M. Note that rf power level remains constant at 5 mW ±1 dB across the band.

Step 5. Select Band 2 at the Model 521. Set F1-START control to 1.0 GHZ, and set F2-STOP control to 4.0 GHz. Then, repeat step 4.

Step 6. Select Band 3 at the Model 521. Set F1-START control to 4.0 GHz, and set F2-STOP control to 8.0 GHz. Then, repeat step 4.

Step 7. Select Band 4 at the Model 521. Set F1-START control to 8.0 GHz, and set F-2STOP control to 12.4 GHz. Then, repeat step 4.

Step 8. Connect external detector to RF OUT connector. Connect oscilloscope to output of external detector. Turn sweep time VERNIER control to a mid-range setting, and depress 1 KHz MODULATION MODE button. Observe that rf output signal, as observed on oscilloscope, changes in amplitude, indicating that modulation is present. Depress RF OFF MODULATION MODE button. The rf power level as observed on oscilloscope shall drop at least 30 dB. Depress CW MODULATION MODE button.

Step 9. Depress CW SWEEP MODE button, and operate Fc/CW control to a mid-range setting. Select Band 1.

Step 10. Measure CW frequency with counter, and verify that the frequency is ±1% of the Fc/CW dial reading.

Step 11. Select Band 2, and repeat step 10.

Step 12. Select Band 3, and repeat step 10.

Step 13. Select Band 4, and repeat step 10.

Step 14. Select Band 3. Turn on the ΔF/CW VERNIER control, and vary the control from one extreme to the other, while observing the change in frequency on the oscilloscope. The frequency shall change by at least 0.2 GHz between the two extremes of the ΔF/CW VERNIER control. Return the ΔF/CW VERNIER control to OFF.

Step 15. Select Band 1. Set the Fc/CW control to 0.5 GHz, and observe the 0.5 GHz line on the oscilloscope. Vary the SLOPE control from one extreme to the other. The rf power level on the oscilloscope shall change by at least 30 dB between the two extremes of the SLOPE control.

Step 16. Select Band 4. Set the Fc/CW control to 12.4 GHz, and observe the 12.4 GHz line on the oscilloscope. Vary the SLOPE control from one extreme to the other. There shall be no effect on the rf power level displayed on the oscilloscope. Return the SLOPE control to the fully counterclockwise position.

Step 17. Select Band 3. Set the Fc/CW control to 6.0 GHz. Observe the 6.0 GHz line on the oscilloscope, and center this line on the display.

Step 18. Depress the Fc ± ΔF X 1 SWEEP MODE button. Set the F2-STOP -ΔF control for a maximum frequency excursion. Slowly turn the sweep time VERNIER control from the X1 to the X10 position, while observing the frequency line on the oscilloscope. The frequency excursion shall be from at least 5.8 GHz to 6.2 GHz.

Step 19. Depress the Fc ± ΔF X .1 SWEEP MODE button. Slowly turn the sweep time VERNIER control from the X1 to the X10 position, while observing the frequency line on the oscilloscope. The frequency excursion shall be from 5.98 GHz to 6.02 GHz.

Step 20. Select Band 1. Depress F1-F2 SWEEP MODE button. Set F1-START control to 0.5 GHz, and set F2-STOP control to 1.0 GHz. Set MARKER 1 control to 0.6 GHz, and set MARKER 2 control to 0.9 GHz. Depress MARKERS AMPL button.

Step 21. Set up the oscilloscope to sweep across Band 1. Slowly turn the sweep time VERNIER control from X1 to X10 while observing the oscilloscope. Stop turning the VERNIER control at the first point where the rf power level drops. The frequency of the CW line on the oscilloscope shall be within ±1% of the MARKER 1 dial reading. Continue turning the VERNIER control toward the X10 position until the rf power level drops again. The frequency of the CW line on the oscilloscope at the point where the power drops shall be within ±1% of the MARKER 2 dial reading.

4.3 REMOTE OPERATION CHECKS

Prepare the system for remote operation by installing the Model 9140 Remote Input Plug into the REMOTE INPUT connector on the Model 551-1 (SP-1046). Connect the remote control unit to the Model 9140 Remote Input Plug.

Step 1. Connect a digital voltmeter (DVM) to the TRACKING VOLTAGE OUTPUT connector.

Step 2. Connect a frequency counter to the RF OUT connector.

Step 3. At remote control unit, set up a digital frequency of 1.0% (0000 0001 0000).

Step 4. At remote control unit, select bands 1 to 4, and verify that DVM and DFC readings are within tolerances, as follows:

Band	DVM Reading (±10 mV)	DFC Reading (±.5%)
1	0.470V	0.47 GHz
2	1.000V	1.0 GHz
3	3.900V	3.9 GHz
4	7.900V	7.9 GHz

Step 5. At remote control unit, set up a digital frequency of 99.0% (1001 1001 0000).

Step 6. At remote control unit, select bands 1 to 4, and verify that DVM and DFC readings are within tolerances, as follows:

Band	DVM Reading (±10mV)	DFC Reading (±.5%)
1	1.030V	1.03 GHz
2	4.000V	4.0 GHz
3	8.100V	8.1 GHz
4	12.500V	12.5 GHz

SECTION V

THEORY OF OPERATION

5.1 OVERALL FUNCTIONAL DESCRIPTION

A system block diagram is provided in figure 1-2. The principal functions of each of the three units are as follows:

a. Model 521. Generates frequency tuning voltage during local operation. Also generates frequency markers in local operation. In both local and remote operation, the Model 521 generates the AM control voltage, which controls the rf output power level.

b. Model 551-1 (SP-1046). Generates quieting control voltage for Model 525 in local operation (manual scan and CW modes). Inhibits Model 521 sweep during remote operation. In both local and remote operation, provides buffering of AM control signal from Model 521 to Model 525, and introduces frequency vs. power slope by means of SLOPE control. In remote operation, converts digital frequency value from remote control unit into an analog frequency tuning voltage. Generates calibrated tracking voltage output in both local and remote operation.

c. Model 525. Generates the CW frequency or frequency sweep specified by the band select and frequency tuning voltage inputs from the Model 551-1 (SP-1046). Uses AM control signal from Model 551-1 (SP-1046) to control rf output power level. In leveled operation, maintains a constant rf power level, regardless of frequency.

5.2 MODEL 521 THEORY OF OPERATION

The Model 521 can be most easily understood by dividing it into its basic sections:

a. Power Supplies
b. Precision Sweep Generator
c. Mode Generator
d. Marker Generator
e. Modulation Circuits
f. Miscellaneous other functions

5.2.1 POWER SUPPLIES (figure 5-1)

The various power supplies in the Model 521 furnish +15V, -15V and +5V highly regulated voltages plus +200V unregulated (connected to the plug-in only).

The four secondaries of T1 feed rectifier and capacitor filter circuits to furnish nominally +200V, two +25V, and +10V DC outputs to the regulators. The +200 is connected directly to the plug-in socket. A resistive tap on the 145V winding furnishes line trigger information for the sweep generator.

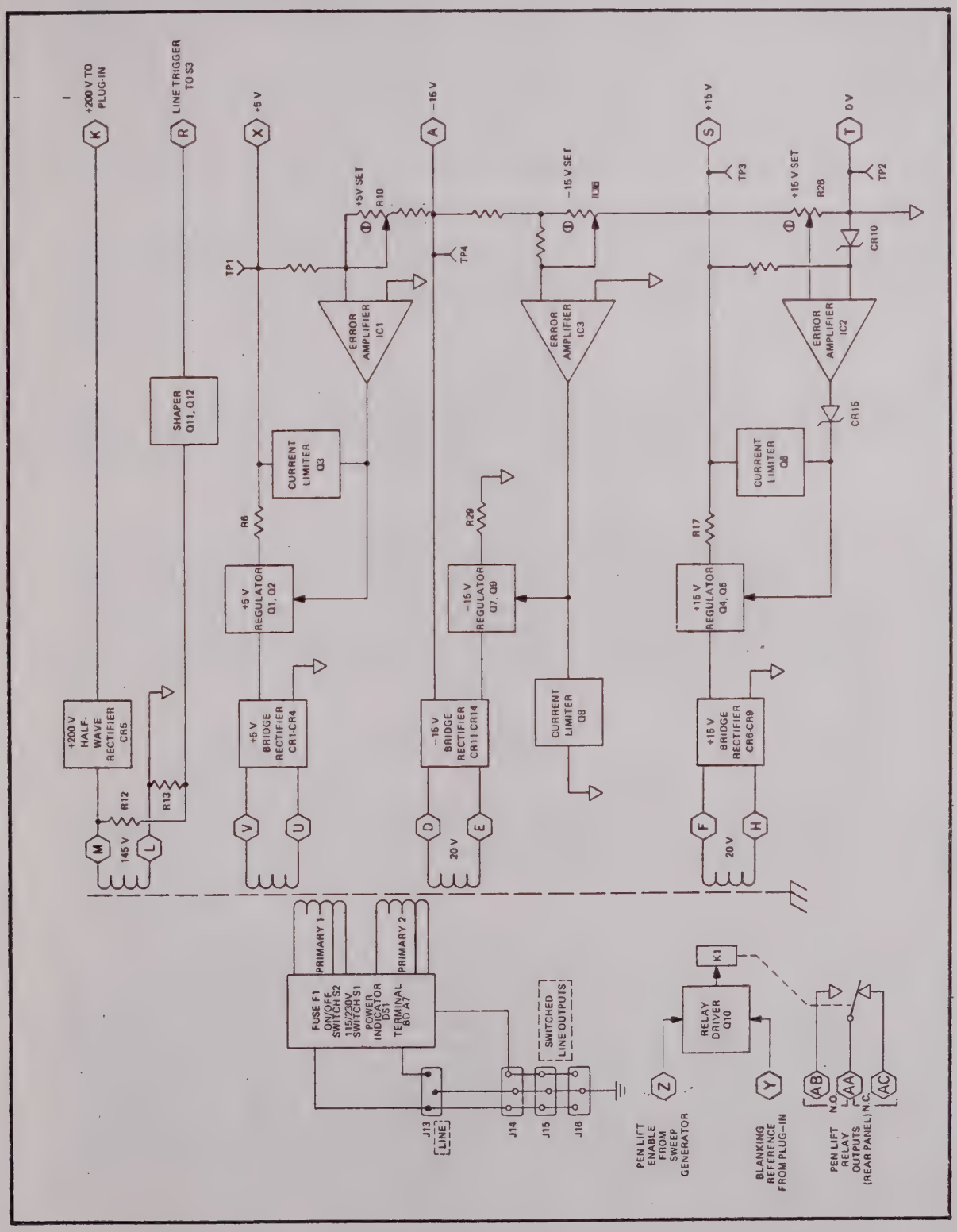


Figure 5-1. Model 521 Power Supply, Block Diagram

5.2.1.1 +15 VOLT SUPPLY. A highly stable reference diode A1CR10 generates a voltage which is compared in A1IC2 with the +15V sense voltage (divided by A1R23, A1R24 and potentiometer A1R26. The pass transistor consists of A1Q4 connected in a Darilington configuration with A1Q5. A1R15 provides the base drive for A1Q5. A1IC2 regulates the output voltage by "robbing" base current from A1Q5 through A1CR15. The output current is sensed by A1R17. The resultant voltage is applied to A1Q6 which shunts the base drive to the output which is applied to A1Q5 when the current limit of approximately .5 amp has been exceeded. This circuit has a foldback characteristic so that the output current drops with increasing output load beyond the current limit.

5.2.1.2 -15 VOLT SUPPLY. The - 15 volt supply operates identically except that the ground point has been moved from the negative side of the bridge rectifier to the emitter of the pass transister. Also, the reference voltage used is the +15 volt supply output which is balanced against the - 15 volt sense voltage and compared of 0V in A11C3. Thus, tracking of the supplies is assured.

5.2.1.3 +5 VOLT SUPPLY. A third similiary operating regulator is the +5V supply. Here the -15V sense voltage is fed into the summing junction of A11C1 through A1R7. The +5V sense is fed into the same junction through A1R8. The current limit is set to approximately 4 amps by A1R4, A1R5 and A1R6.

An understanding of the regulatory action of these supplies can best be reached by tracing their corrective action. For example, suppose the load on the +15 volt supply is increased slightly causing a slight voltage drop. This drop is sensed and causes a drop in the voltage applied to pin 2 of A11C2. Since this is an inverting input, the output at pin 6 will rise so that less current will be taken from A1Q5 base. The increase in base drive will cause a lower collector-emitter voltage drop in A1Q4 and thus compensates for the original drop.

5.2.2 PRECISION SWEEP GENERATOR (figure 5-2)

The heart of the frequency control circuitry of the Model 521 is the precision 0 to +10V ramp generator. This unit is responsible for the triggering and various time base circuits, the manual scan function, and generation of blanking and quieting signals. The sweep stop circuitry for intensity markers is also contained here.

The basic ramp generator is A21C1 connected as a classical Miller integrator. In upward sweep mode a constant current is fed into the summing junction, pin 2, through resistor A2R13. The capacitor (A2C2, C3, C4 or C5) connected from the output, pin 6, to the same junction causes the output voltage to be a linearly increasing ramp whose slope is proportional to the input current. Decade sweep speed selection is made by selecting the value of the capacitor. Setting the sweep speed vernier potentiometer varies the voltage applied to A2R13 and thus the current fed into the summing junction. A2R26, connected from the bottom of the vernier to ground limits the lower value of current so as to give a 10:1 vernier range.

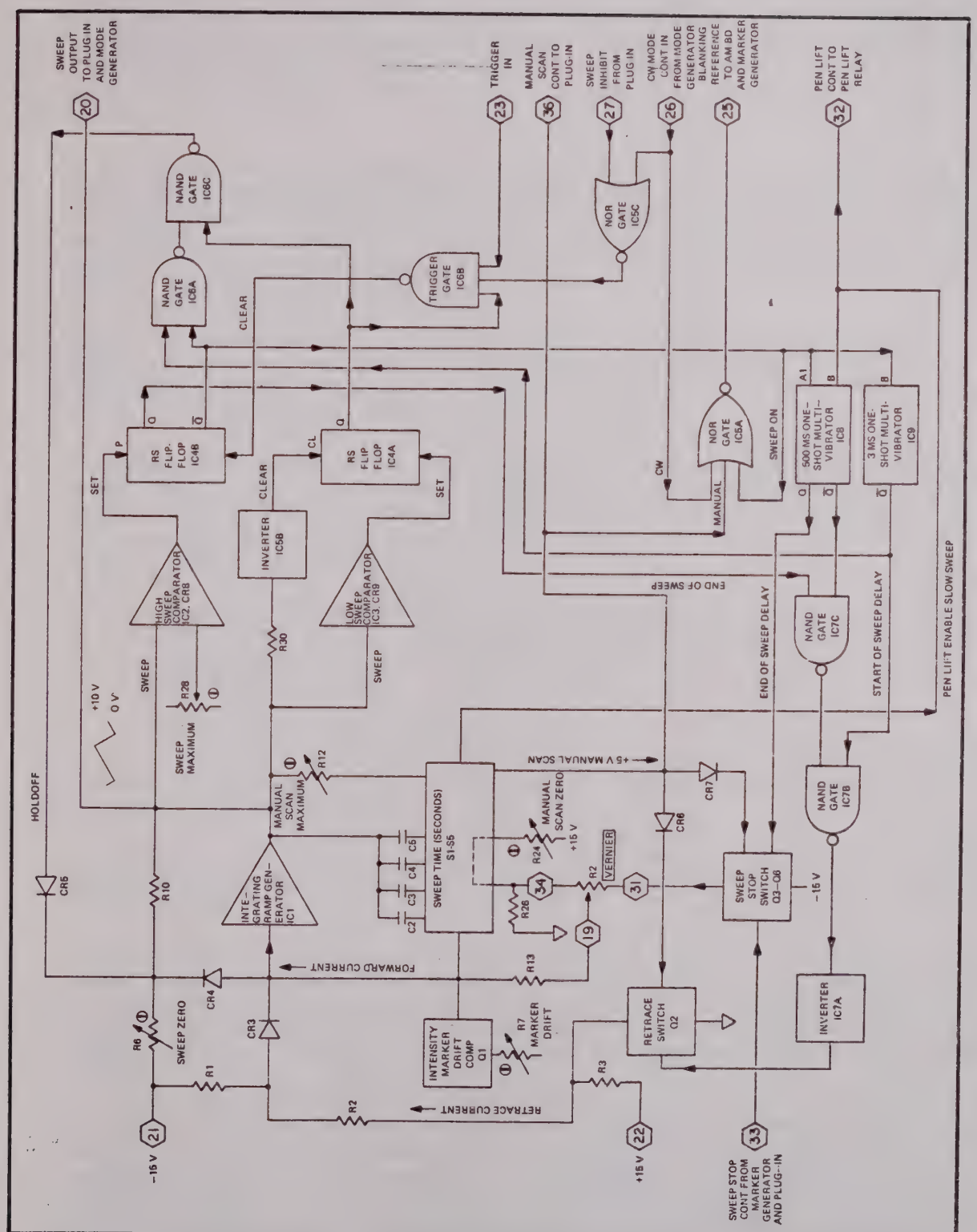


Figure 5-2. Sweep Generator, Block Diagram

In the MANUAL SCAN mode the integrating capacitor is replaced by two feedback resistors A2R11 and A2R12 so that A2IC1 functions as a normal inverting operational amplifier. At the same time S5 disables sweep retrace, sweep stop and blanking functions and switches A;R25 and A1R24 to set manual scan zero. A1R24 and A1R12 calibrate the manual scan 0 + 10V range for an output range of 0 to +10 volts.

In the sweep mode, the sweep retrace is accomplished by saturating transistor A2Q2. This causes a current roughly 11 times the magnitude of the maximum current available through A2R13, of the opposite polarity, to pass through A2R2 and A2R3 in series and into the summing junction. This overcomes the current supplied by A2R13 and causes a reverse integration and therefore an output retrace, control of A2Q2 will be discussed later.

When A2CR5 anode is low the network A2R5, A2R6, A2R10 and A2CR4 cause the output of A21C1 to remain at 0V as adjusted by potentiometer A2R6. For swept operation the effect of the "0V clamp" network is eliminated by a positive voltage on the anoide of A1CR5.

The output from A2IC1 is fed to the Mode Generator card and also to the rear panel sweep output connector. It is also fed to comparators A2IC2 and A2IC3 which sense the low and high end of the sweep. To understand the operation of the logic circuits assume the following states which will be true if a normal forward sweep is in progress:

a. Retrace control transistor A2Q2 saturated.
b. Flip-flop A2IC4B in clear state (Q at 0, $\overline{Q}$ at 1).
c. Flip-flop A2IC4A in clear state (Q at 0).
d. CW mode input at 0.
e. The manual scan line at 0.
f. Sweep stop switch, A2Q4 saturated.

The 1 at the $\overline{Q}$ output of A21C4B forces the output of the NOR gate A21C5A to be 0 resulting in no blanking.

The NAND gate A21C6C whose output is held at 1 by the 0 input from the flip-flop A21C4A provides the hold-off voltage applied to the 0V clamp circuit of the integrater.

If the INTENSITY markers are being employed, an output from a oneshot on the marker board will open switch transistor A2Q4 briefly at each marker. Since the output of the integrater only moves in response to an input current, the output holds its voltage whenever the switch is opened. A special circuit consisting of A2R7, A2R8 and A2Q1 compensates for whatever residual drift occurs.

When the +10 volt level is reached, comparator A21C2 sets the status flip-flop #1, A21C4B. Serveral things now happen simultaneously depending on whether the 521 is in a slow or fast sweep mode. If in a fast mode, the 500 ms ONE-SHOT is inhibited and ignores the negative trigger applied when IC4B$\overline{Q}$ goes to 0. $\overline{Q}$ going to 0, however allows A21C5A output to rise to 1 and send a blanking signal out. The A21C4B Q output drives NAND gate A21C7C output to 0 which drives A21C7B to 1 which is inverted to 0 by A21C7A which unsaturates the retrace control transistor and starts reverse integration.

If a slow sweep mode is employed, this action is modified in several ways. First, a pen-lift relay enable level will be present which allows the pen lift relay to respond to the blanking signal. Second, the 500 ms one-shot will fire on the negative transition of A2IC4B $\overline{Q}$ output. The negative pulse will open the sweep-stop switch to hold the output at +10V. Simultaneously, the effect on A2Q2 will be to disable the retrace circuit until the end of delay.

When the 0V is reached in the retrace, the 0V comparator fires setting A2IC4A. The transition of the Q output to 1 immediately removes the hold-off signal from A2IC6A, enabling the 0V clamp to hold the sweep at 0V. The 1 now present at A2QIC4A enables the trigger gate A2IC6B. Assuming the gate has not been inhibited by the CW mode "1" signal or a signal from the plug-in, it will trigger as soon as a "1" is present on the third input. Depending on the position of the TRIGGER switch, there are four sources of this signal. In INT mode it is always available and triggering will occur immediately. In LINE it will occur whenever transistor A1Q11 unsaturates. In MAN, a pulse sufficient to trigger will occur whenever the button is pushed, and in EXT a pulse of sufficient amplitude maybe coupled through C5.

The trigger signal causes the trigger gate A2IC6B to clear flip-flop A2IC4B. This causes several simultaneous actions: the blanking signal is removed; the 3 ms one-shot fires; the input to A2IC7C goes to 0 and the input to A2IC6A goes to 1. A2IC4B Q output going to 0 would remove the retrace current and allow forward integration to begin except that the 3 ms one-shot holds it on. Similiarly, the $\overline{Q}$ output going to 1 would disable the hold-off circuit except that the one-shot output prevents that.

At the end of 3 ms, the hold-off is disabled and the retrace is shut off allowing the cycle to start over.

The operation of this circuit is further modified in two ways. In either CW or Manual Scan modes, the blanking output is removed, and the sweep is inhibited.

5.2.3 MODE GENERATOR (figure 5-3)

The Mode Generator, consisting of A3 and associated components, modifies the 0 to +10V output of the Sweep Generator to provide an output in the 0 to -10 volt range which drives the RF oscillator frequency control circuits. This output is also available at the rear panel FREQ REF volts jack. The Mode Generator also generates the analog reference signals used in the Marker Generator.

5.2.3.1 F1-F2 MODE In the wide sweep mode, the input ramp is fed to F_2- Stop potentiometer directly. It is also fed to A3IC3 which inverts it and offsets it so that it becomes a +10 to 0 volt ramp. This is fed to F_1-Start potentiometer A3R5. The wipers of both pots are fed into the input of the frequency reference volts output amplifier consisting of A3IC4, A3Q1 and associated components.

If the F_2-Stop potentiometer is full clockwise and the F_1-Start potentiometer full counter-clockwise, then the full 0 to +10V ramp is fed into the frequency reference volts output amplifier and is inverted to provide a 0 to -10V output ramp which will sweep the RF oscillator over its full range. Turning the F_1-Start potentiometer clockwise will add to the output waveform varying degrees of the +10V to 0 volt sawtooth in such a way that the start voltage of the

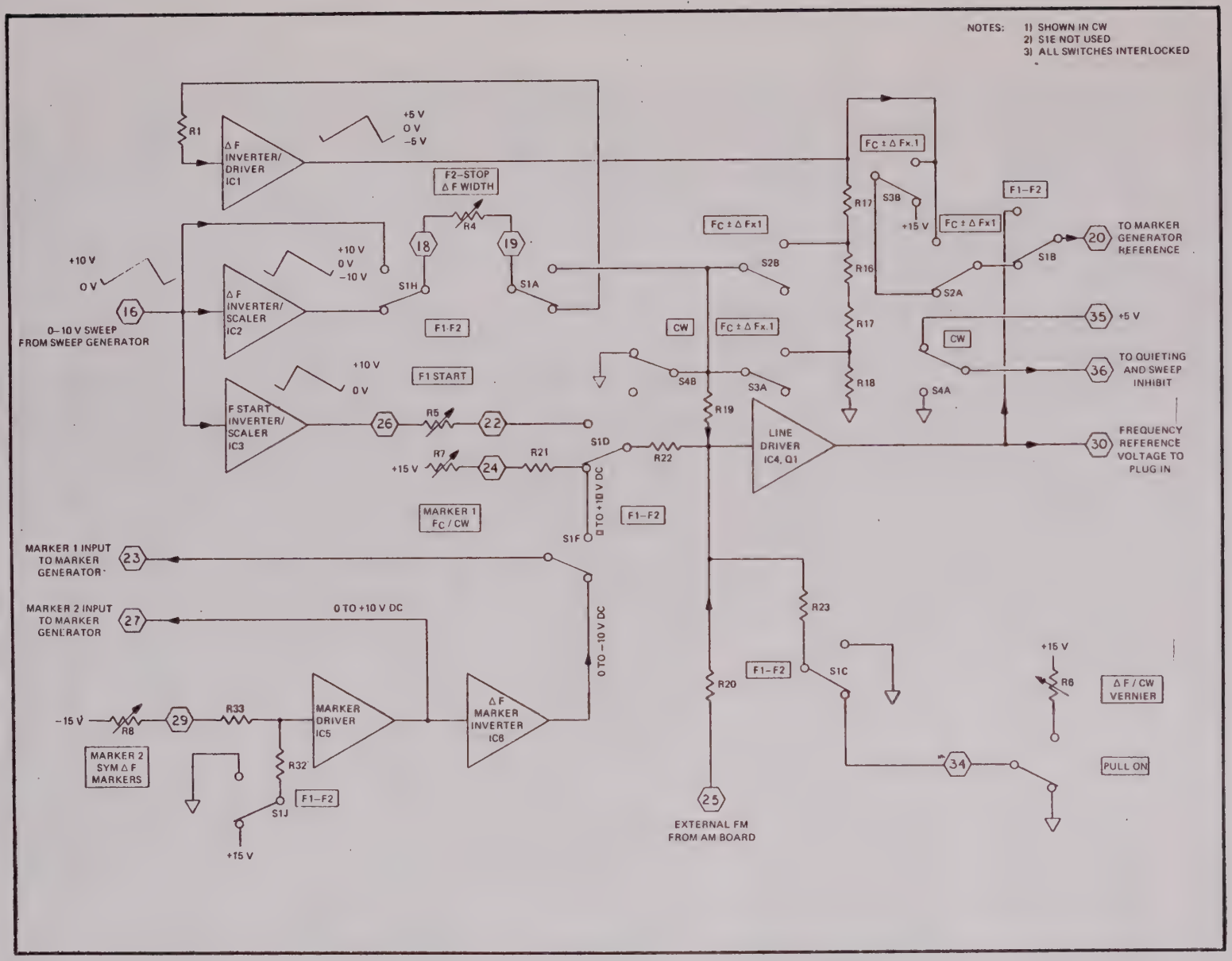


Figure 5-3. Mode Generator, Block Diagram

output ramp can be decreased linearly from 0V to -10V. Similiary the F_2-Stop potentiometer can be rotated counter-clockwise linearly increasing the end-of-sweep output voltage from -10V to 0V. With the controls thus reversed it is possible to sweep the full band in reverse if so desired.

5.2.3.2 F1-F2 MODE MARKERS In this mode the MARKER 1 potentiometer is connected to through resistor A3R21 and switch A3S1-F to provide a 0 to +10 volt input to the marker generator M1 input. The MARKER M2 potentiometer generates a 0 to -15 volt signal which is inverted and scaled by A3105 into a 0 to +10 volt signal which is fed to the marker generator M2 input. The frequency reference volts output is fed into the marker generator reference input. How the marker generator uses this voltage will be discussed later.

5.2.3.3 ΔF MODES In the ΔF modes, the M1/Fc potentiometer is connected to the frequency reference volts output amplifiers so that, in the absence of other inputs, the output is inverted and scaled to 0 to -10 volts. This sets the center frequency. The 0 to +10 volt ramp is fed into A3IC2 which inverts, scales and offsets it into a +10 to -10 volt ramp which is fed through A3S1-H to the ΔF potentiometer. The output of this potentiometer is again inverted by A2IC1 and fed through a decade selector switch A3S2A and A3S3B (ΔFX1, ΔFx.1) and into the frequency reference volts output amplifier. This signal provides the symmetrical ΔF sweep determined by the decade selector and the setting of the ΔF potentiometer.

5.2.3.4 ΔF MARKERS The 0 to $\pm$ 10 volt ramp output of A3IC1 is sampled before the decade selector and fed to the Marker Generator reference input through A3S1B and A3S2A. There it is compared to the M2 input already present and the same voltage inverted by A3IC6 and fed through A3S1-F into the M1 input. An analysis of the voltages involved will shown that this results in a marker each side of center displaced by the ratio of the settings of the M2/SYM ΔF MARKERS pot and the F_2-STOP/ΔF pot. Thus the ΔF markers are directly calibrated in frequency relative to Fc.

5.2.3.5 CW MODE In CW Mode, only the Fc potentiometer is connected to the frequency reference volts output amplifier. The Marker Generator reference input is clamped out of range to +15 volts and a +5 volt output signal is provided which inhibits the sweep and blanking from Sweep Generator and while signaling CW operation to the interface plug-in.

5.2.3.6 FREQUENCY VERNIER In the ΔF or CW modes, the frequency vernier is connected to the line driver input through its own switch. Thus it provides a fine adjustment of the center frequency.

5.2.4 MARKER GENERATOR (figure 5-4)

The Marker Generator consists of board A4 and associated controls. It uses the signals provided by the Mode Generator to provide:

a. Rear panel - 1V marker signals.
b. Voltage to AM modulate to RF plug-ins through the Modulation Circuitry.
c. Sweep-stop pulses to the Sweep Generator for intensity markers.

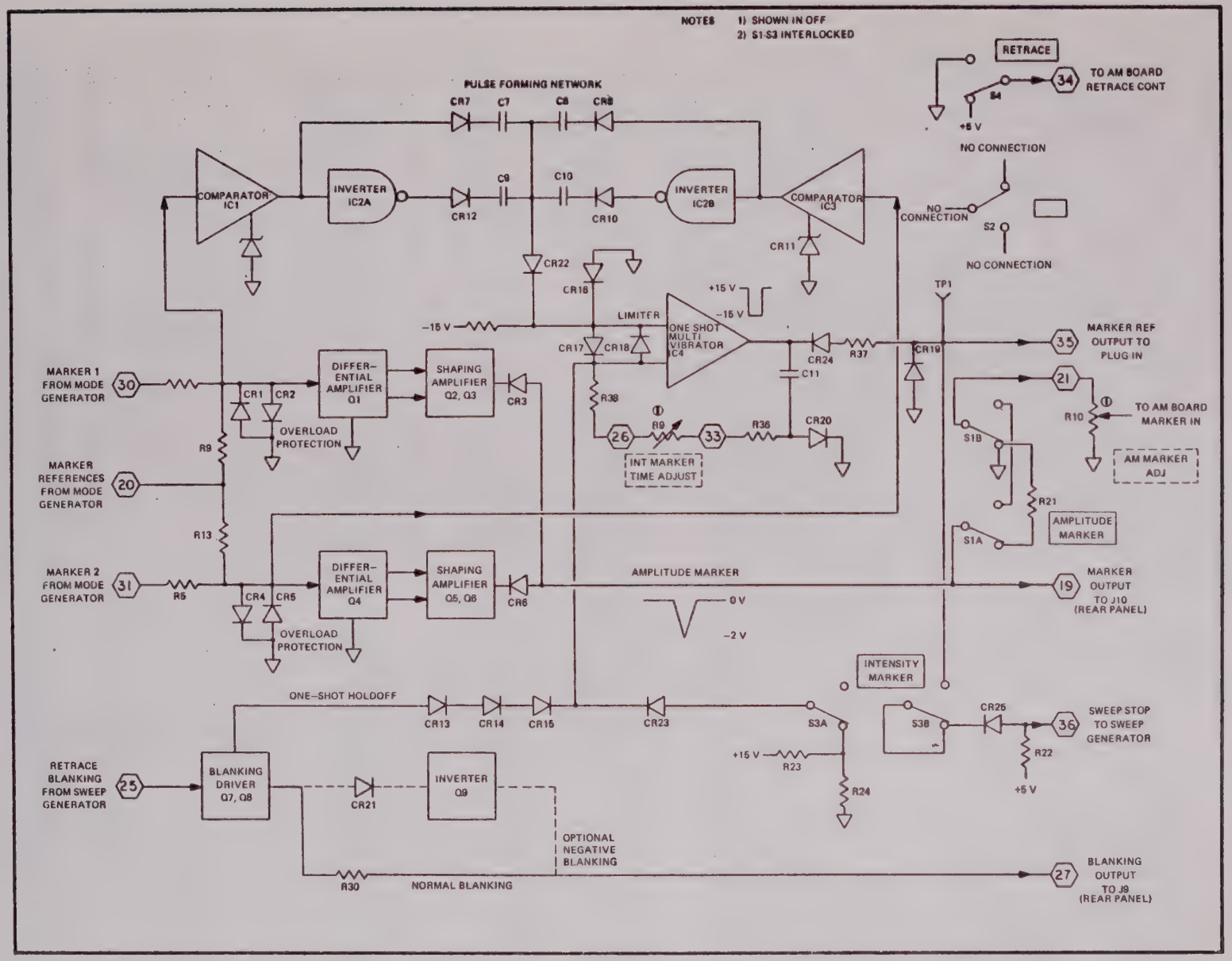


Figure 5-4. Marker Generator, Block Diagram

Additionally it contains the high level driver for rear panel +14 or -14 volt blanking output signals and the retrace blanking switch.

5.2.4.1 MARKER OUTPUT GENERATOR The circuit consisting of A4Q1, A4Q2 and A4Q3 and associated components (and another identical circuit consisting of Q4, and Q5 and Q6) function as modified operational amplifiers. The marker generator compares the absolute amplitudes of each of the M inputs to the reference input. Thus, the positions of the two markers are compared directly with the frequency reference voltage, resulting in two markers directly calibrated in output frequency. When the external currents into the summing point (junction of A4R1 and A4R9) are equal, the circuit generates a -1 volt pulse. The M1 and M2 pulses are summed in the output line and fed to the Marker Output jack on the rear panel. The -1 volt pulse is also fed to the rear panel Marker Adjust and then to the Modulation Circuitry board.

5.2.4.2 INTENSITY MARKER CIRCUIT The summing points are also sensed by comparators A4IC1 and A4IC3. Whenever the input passes 0V, the output flips from one state of the other. A4IC2 A and A4IC2 B act as inverters on the outputs of A4IC1 and A4IC3 so that anytime a marker is passed one of the four output states will have a positive going transition. A4IC4 is connected as a one-shot which produces a TTL low output pulse of several milliseconds (adjustable by A4R9). This is sent to the Sweep Generator sweep-stop circuit. The circuit is disabled by the retrace blanking circuit which prevents intensity markers during sweep retrace.

5.2.4.3 BLANKING DRIVER A4Q7, A4Q8 and, optionally A4Q9 form the blanking driver. If resistor A4R30 is installed +14 volt blanking occurs; if A4R30 is deleted and A4CR21, A4R31, A4R32, A4Q9 and A4R33 are installed and -14 volt blanking occurs.

5.2.4.4 RETRACE CONTROL Switch A4S4 provides a +5V level in "Retrace OFF" condition and is provided for control of retrace blanking in the Amplitude Modulation Board.

5.2.5 MODULATION CIRCUITRY (figure 5-5)

The Amplitude Modulation functions are controlled by board A5 with its associated circuitry. All amplitude modulation functions are generated and/or controlled here including:

a. Retrace blanking.
b. 1 KHz modulation.
c. AM markers.
d. RF-off switching.
e. Power setting.
f. External AM modulation.

In addition, the external FM modulation is switched on this board.

5.2.5.1 POWER ADJUST Operational amplifier A5IC1 provides a stable -10V reference voltage which is fed to power control potentiometer A5R12. The voltage at the wiper of R12 is inverted and scaled to produce a 0 to +67 volt output with the knob pushed in or 0 to +2 volt output with it pulled out. This

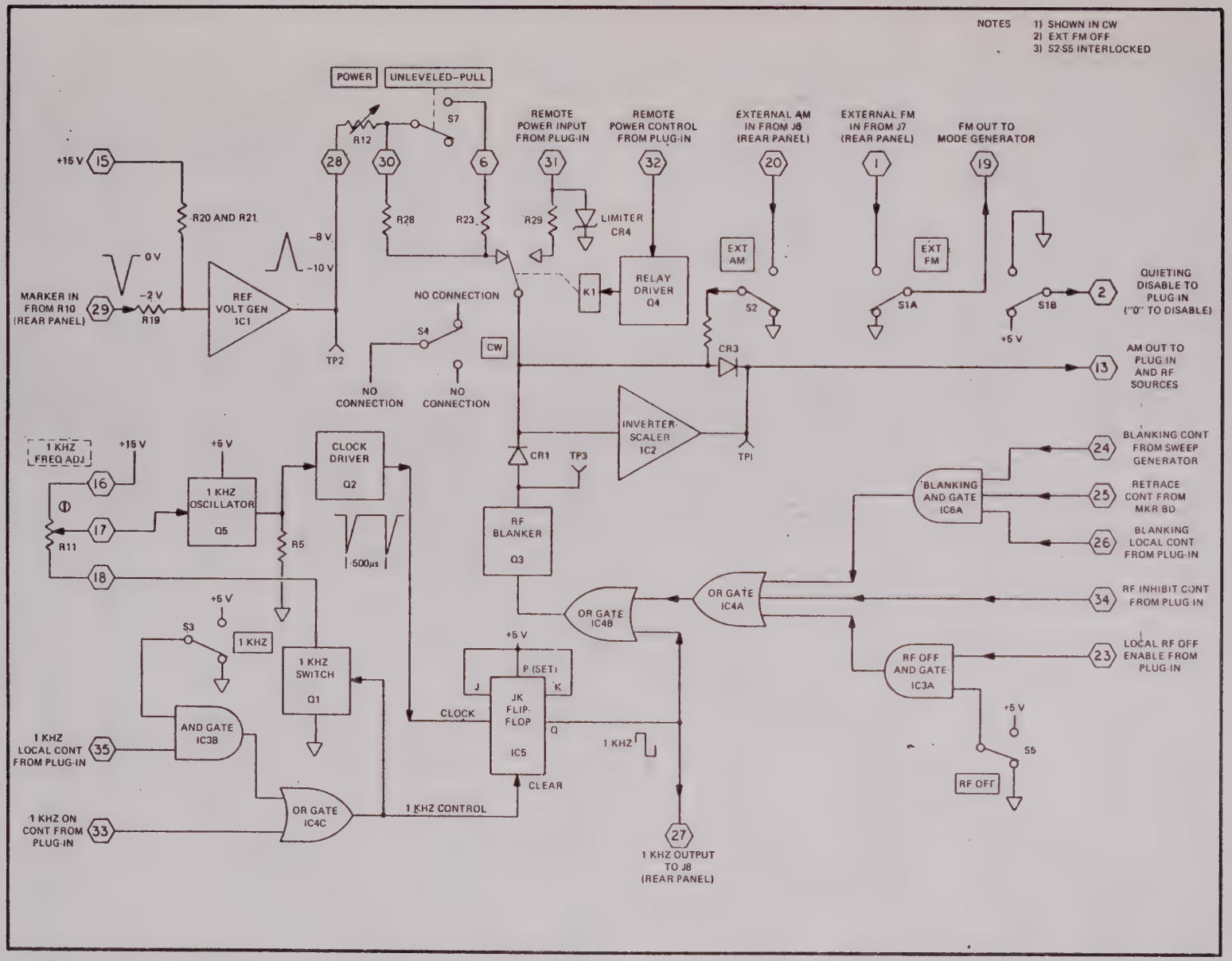


Figure 5-5. AM Board, Block Diagram

is fed to the external AM port of the RF source where it controls the power output. If an external signal (from the RF source) switches the feed relay, the internal POWER control will be disabled and another plug-in pin will be enabled to provide this function.

5.2.5.2 AM MARKERS The voltage from the wiper of the rear panel amplitude marker adjust is also fed into the input of A5IC1 and is used to amplitude modulate the voltage fed the power control potentiometer.

5.2.5.3 EXTERNAL AMPLITUDE MODULATION In addition to the power set control, an independent input to the AM driver A5IC2 comes from the EXTERNAL AM jack through A5S2. This input sums with the power control input.

In addition to the various linear modulation modes available, several circuits require only on-off modulation. The circuits act to control A5Q3. If A5Q3 is saturated, diode A5CR1 will be back biased and out of the circuit. If A5Q3 is non-conducting, the diode becomes forward biased and forces the driver towards negative saturation. It is clamped at -.6 volt by A5CR3.

Transistor A5Q3 will be cut off (RF blanked) if the output of A5IC4B is high. This will be true if either A5IC4A is high or A5IC5 output is high. A5IC4A will be high if any of its inputs is high. One of these inputs, RF INHIBIT, comes from the plug-in and allows remote control of RF OFF. Another input comes from the output of AND gate A5IC3B. This output will be 1 if the RF OFF switch is in unless the RF ENABLE input from the plug-in is 0.

A third input to A5IC4A comes from AND gate A5IC6A. This output will be high when the retrace blanking signal from the Sweep Generator is present provided the RETRACE button on the Marker Generator is OUT and provided that the RE-TRACE BLANKING ENABLE line from the plug-in is high.

5.2.5.4 1 KHz MODULATION A5Q5 is a programmable unijunction transistor. It functions as a pulse train generator as follows: A voltage is provided on the gate terminal from the arm of the 1 KHz adjust pot. The anode voltage builds up with a time constant determined by A5R8 and A5C1. When the anode voltage exceeds the gate voltage, the UJT fires and dumps the capacitor charge across A5R5. Driver A5Q2 clocks the J-K flip-flop A5IC5 each time a pulse occurs. The resultant squarewave output forms the second input to AIC4B. The circuit is functional only when the anode voltage can exceed the gate voltage so cutting off A5Q1 shuts off the pulse generator. A5IC4C performs this function and simultaneously clears A5IC5 whenever its inputs are low. The 1 KHz function may thus be turned on by either the remote 1 KHz ON or A5IC3A. A5IC3A will be high whenever the 1 KHz switch is in unless the plug-in LOCAL 1 KHz ENABLE line is low.

5.2.6 BAND SELECT CIRCUIT. The band select switch, SS in conjunction with 8, 1 K ohm resistors provides a TTL negative band select output.

5.2.7 UNLEVELED LAMP. The Model 525 unleveled lamp output is an open-collector NPN transistor which saturates in unleveled condition. Lamp I1, connected between +5V and the transistor will then illuminate.

5.3 MODEL 551-1 (SP-1046) THEORY OF OPERATION (figure 5-6)

Figure 5-6 is a detailed block diagram of the Model 551-1 (SP-1046), showing the signal interconnections to the Model 521, the Model 525, and the remote control unit. The block diagram shows the jumper connections made when either the Model 9139 Jumper Plug or the Model 9140 Remote Input Plug is installed.

5.3.1 JUMPER CONNECTIONS ON PLUG-IN CONNECTOR TO MODEL 521

The Model 551-1 (SP-1046) contains jumper connections on the plug-in connector (P1) as follows:

a. The Sweep Output signal from the Model 521 is jumpered to the Sweep to Panel input to the Model 521. This line is connected to the SWEEP OUTPUT connector.

b. The Freq. Ref. Volt output signal from the Model 521 is jumped to the Freq. Ref. to Panel input to the Model 521. This line is connected to the FREQ VOLTS connector.

c. The Local RF Off Enable and 1 KHz Local Control input lines to the Model 521 are connected to +5 volts.

d. The Remote Power Control, RF Inhibit Control, and 1 KHz On Control line inputs to the Model 521 are connected to ground.

5.3.2 JUMPER CONNECTIONS MADE BY MODEL 9139 JUMPER PLUG

The following jumper connections are made when the Model 9139 Jumper Plug is installed in REMOTE INPUT connector J2:

a. The Slope On-Off control line to transistor switch A1Q1 is open-circuited. This permits A1Q1 to conduct, energizing slope control relay A1K1.

b. The Freq. Ref. Volt output from the Model 521 is connected to the Tracking Voltage Generator input, and to the Tuning Voltage output line to the Model 525.

c. The four Band Select lines from the Model 521 are connected to the Tracking Voltage Generator, and to the Band Select output lines to the Model 525.

d. +5 volts is connected to the Local Blanking Control Enable input line to the Model 521, and to inverter A1U1. The resulting ground from inverter A1U1 is applied to the Sweep Inhibit input to the Model 521.

5.3.3 JUMPER CONNECTIONS MADE BY MODEL 9140 REMOTE INPUT PLUG

The following jumper connections are made when the Model 9140 Remote Input Plug is installed in REMOTE INPUT connector J2:

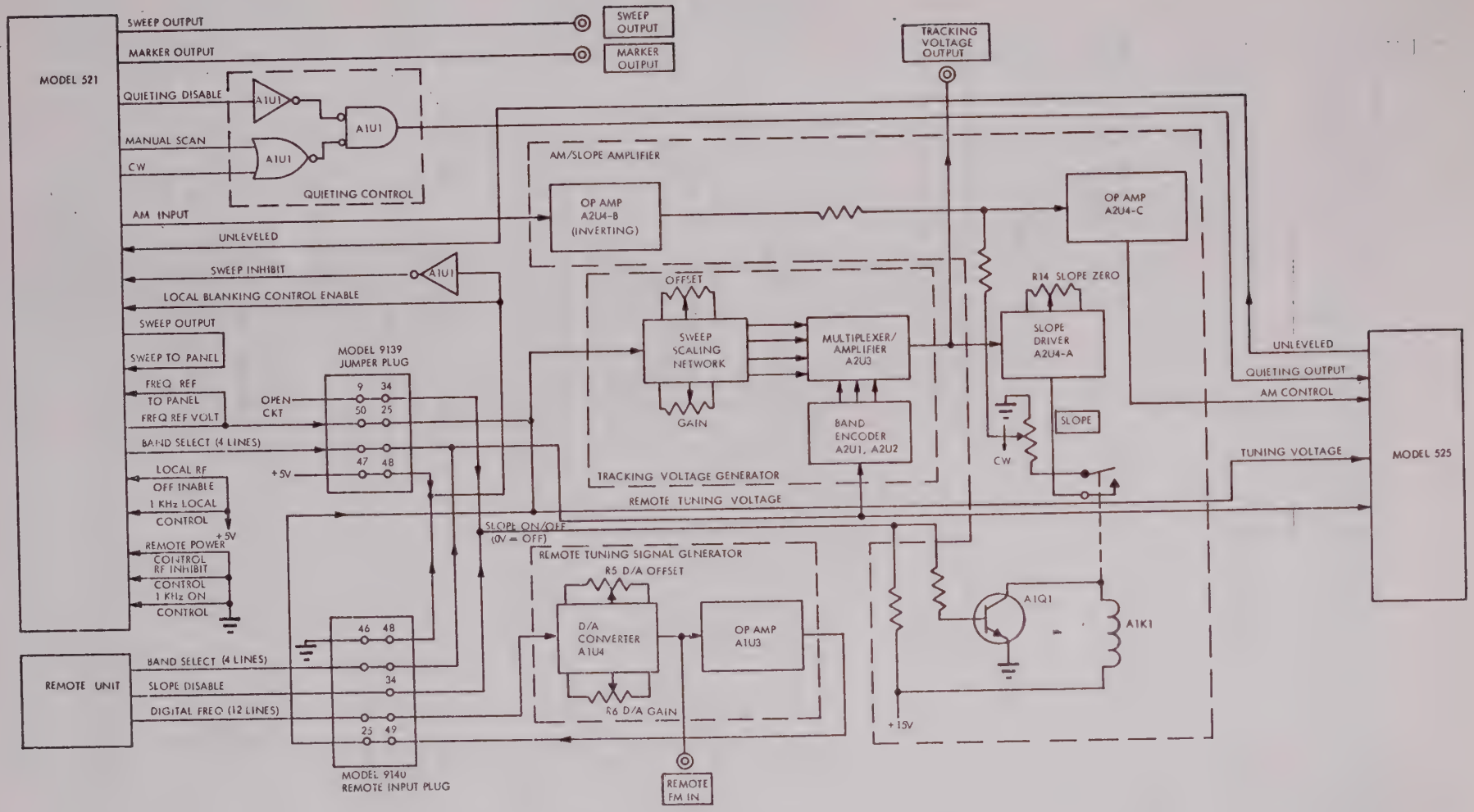


Figure 5-6. Model 551-1 (SP-1046), Detailed Block Diagram

a. A ground is connected to the Local Blanking Control Enable input line to the Model 521, and to inverter A1U1. The resulting +5 volt output from inverter A1U1 is applied to the Sweep Inhibit input to the Model 521.

b. The four Band Select lines from the remote control unit are connected to the Tracking Voltage Generator, and to the Band Select output lines to the Model 525.

c. The Slope Disable input from the remote control unit is connected to transistor switch A1Q1. A 0 volt input on this line turns off A1Q1, which deenergizes slope control relay A1K1.

d. The 12 Digital Frequency input lines from the remote control unit are applied to the Remote Tuning Signal Generator.

e. The Remote Tuning Voltage output of the Remote Tuning Signal Generator is connected to the Tuning Voltage line to the Tracking Voltage Generator, and to the Model 525.

5.3.4 REMOTE TUNING SIGNAL GENERATOR

The 12-bit digital frequency input (LSB = 0.1 percent, MSB = 80 percent) from the remote control unit is applied through the Model 9140 Remote Input Plug to digital-to-analog (D/A) converter A1U4. The resulting analog voltage output from A1U4 is positive, and is inverted in amplifier A1U3. Calibration of the D/A output is accomplished by D/A Offset adjust R5 and D/A Gain Adjust R6. The digital frequency input values are in the range from 0.0 percent to 99.9 percent, corresponding respectively to the bottom and top of the selected frequency band. A digital frequency value 0.0 percent produces a D/A output of 0 volts from A1U3, and a digital frequency value of 99.9 percent produces a D/A output of -9.99 volts from A1U3. The usable tuning range is from -0.1 volt to -9.90 volts. This corresponds to a total of 980 discrete frequencies which can be specified within each band by the digital frequency input. The frequency resolution for any given band is obtained by dividing 980 into the width of the band in GHz.

A rear panel REMOTE FM IN connector permits the addition of an external FM signal to the D/A output from A1U4. This input is summed with the output of A1U4 at the summing junction of amplifier A1U3. A +1 volt change in the FM input produces a -0.245 volt change in the tuning voltage output from A1U3.

5.3.5 TRACKING VOLTAGE GENERATOR

The tuning voltage (local or remote) selected by the installed jumper plug is applied to the Tracking Voltage Generator, which produces a calibrated 1V/GHz output to the TRACKING VOLTAGE OUTPUT connector on the rear panel. This voltage has a calibrated range from +0.470 volts to +12.50 volts, corresponding to a frequency range of 0.47 GHz to 12.5 GHz.

The selected tuning voltage is applied to Multiplexer/Amplifier A2U3 through a Sweep Scaling Network which contains a Band Offset Adjust and a Band Gain Adjust for each of the four bands.

The four Band Select lines (local or remote) selected by the installed jumper plug are applied to a Band Encoder consisting of A2U1 and A2U2. A low input on one of the four Band Select lines causes the Band Encoder to produce a 3-bit code which is applied to Multiplexer/Amplifier A2U3. This 3-bit code selects the scaled tuning voltage (from the Sweep Scaling Network) for the selected band as the active input which is amplified by A2U3. The Band Offset Adjust for the selected band sets the output from A2U3 when the tuning voltage input is -0.1 volt. The Band Gain Adjust for the selected band sets the gain of A2U3 to obtain the correct output when the tuning voltage input is -9.9 volts. The Band Offset and Band Gain adjustments are set so that the TRACKING VOLTAGE OUTPUT corresponds in voltage to the frequency in GHz for the bottom and top of each band. The tracking voltage is also supplied to the AM/Slope Amplifier.

5.3.6 AM/SLOPE AMPLIFIER

The positive (0 to +2V) AM control signal from the Model 521 is supplied through inverting amplifier A2U4-B to inverting amplifier A2U4-C. This signal is summed at the summing junction of A2U4-C with the slope voltage from the wiper of the SLOPE control potentiometer. The resulting output (-.6V to +2V) from A2U4-C is applied as the AM Control signal to the Model 525.

Slope Driver A2U4-A receives the tracking voltage from the Tracking Voltage Generator. The A2U4-A output is a positive voltage whose magnitude diminishes as the tracking voltage increases. When the tracking voltage is +12.5 volts, corresponding to 12.5 GHz, the Slope Driver output is set at 0 volts by means of Slope Zero Adjust A2R14.

The slope voltage output from the Slope Driver is supplied through the normally open contacts of slope control relay A1K1 and the SLOPE control potentiometer to the summing junction of amplifier A2U4-C. The effect of the slope control voltage is to attenuate the AM control signal by an amount proportional to both the setting of the SLOPE control and the magnitude of the slope control voltage.

5.3.7 QUIETING CONTROL

When the Quieting Disable line from the Model 521 is low and the Model 521 is selecting either the CW sweep mode or the manual scan sweep time mode, a high Quieting logic level is produced and supplied to the Model 525.

5.4 MODEL 525 THEORY OF OPERATION (figure 5-7)

Figure 5-7 is an overall block diagram of the Model 525, showing the signal connections to the Model 551-1 (SP-1046), and a detailed block diagram of the leveling circuits. The four Band Select lines from the Model 551-1 (SP-1046) are supplied through inverters to the four rf modules. A low (0 volt) Band Select signal from the Model 551-1 (SP-1046) selects the corresponding rf module, which produces an rf output whose frequency is determined by the Tuning Siganal input. The rf output is supplied to one of four input ports (one port for each module) on an RF Switch. Associated with each input port is an amplitude modulation (AM) signal line from the leveling circuits. The AM signal for the selected rf module is a positive-going signal that controls the amplitude of the rf output from the associated input port. The AM signals for the deselected rf modules are negative, shutting off their associated input

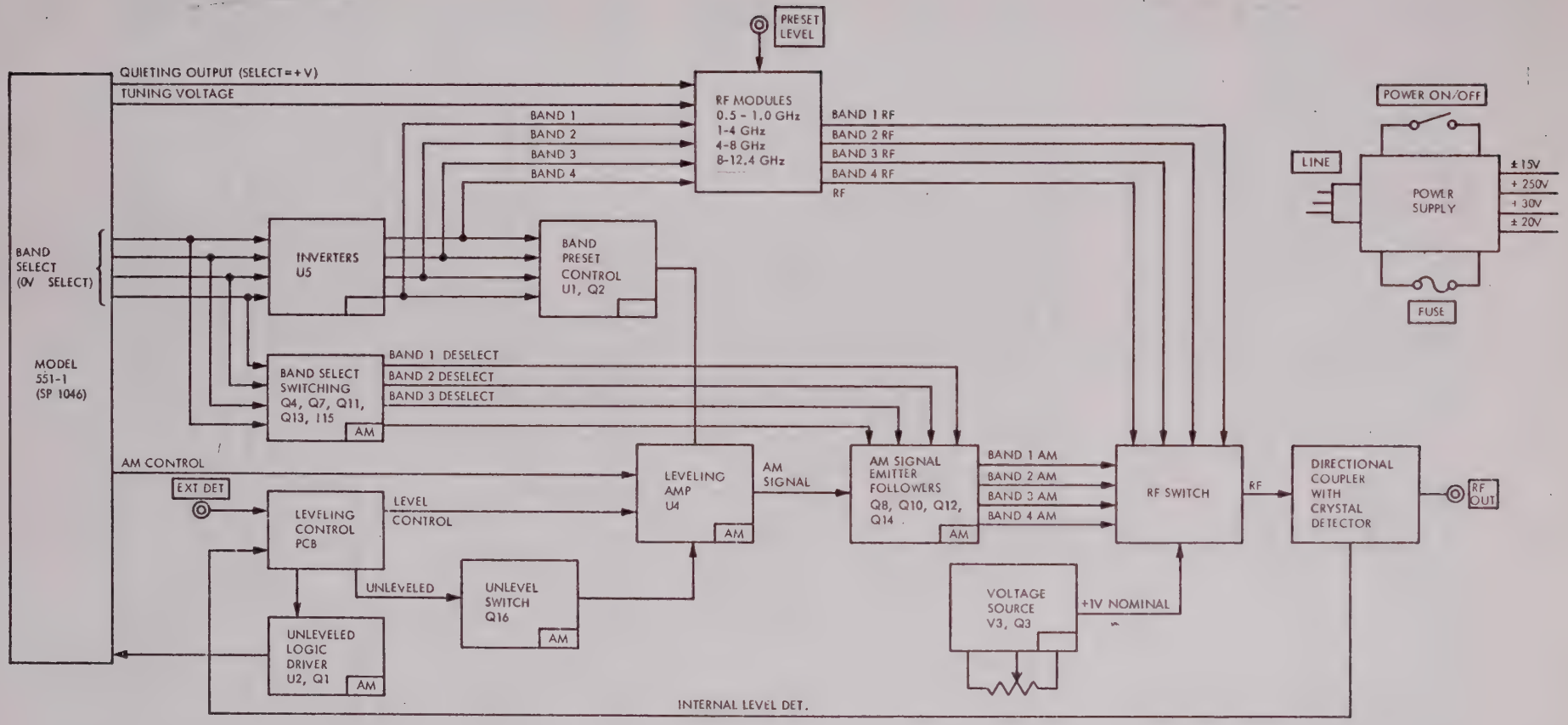


Figure 5-7. Model 525, Detailed Block Diagram

ports, thus the rf output is derived solely from the selected rf module. The rf output from the RF Switch is supplied to a directional coupler. One output port of the directional coupler is connected to the RF OUT connector. The other output port contains a crystal detector that produces a feedback signal (Internal Level Detect) proportional to the rf output level. When the internal leveling mode is selected, this feedback signal is amplified and summed with the AM Control signal from the Model 551-1 (SP-1046). The resulting AM Signal supplied to the RF switch maintains the rf output level within ±1 dB of the level established by the power control on the Model 521.

5.4.1 LEVELING CIRCUITS, DETAILED DESCRIPTION

The leveling circuits are contained on the Leveling Control PCB and the AM Control PCB.

5.4.1.1 LEVELING CONTROL PCB The INTERNAL/EXTERNAL LEVELING pushbuttons select which feedback signal (internal from the directional coupler, or external from the EXT DET connector) is applied to X10 differential amplifier U1. If the UNLEVELED pushbutton is not pressed, the amplified output of U1 is supplied as the Level Control signal to the AM Control PCB. Also, the Unleveled line is at 0 volt, and the Leveled signal line is open-circuited. If the LEVELED pushbutton is pressed, amplifier U1 is bypassed, the Leveled signal line is at 0 volts, and the Unleveled signal line is open-circuited.

5.4.1.2 AM CONTROL PCB When the UNLEVELED pushbutton on the Leveling Control PCB is not pressed, Unlevel Switch Q16 (FET) is switched off, and Leveling Amplifier U4 sums and inverts the following signals:

a. AM Control signal from the Model 551-1 (SP-1046). This signal sets the rf output level.

b. Level Control signal from the Leveling Control PCB. This signal provides the feedback that maintains the power level within ±1 dB of the level set by the AM Control signal.

c. Present Level from Band Preset Control U1/Q2. The inverted Band Select signals from inverter U5 are applied to this circuit. The Band Select signal for the selected band is high from the inverter, causing the Band Present Control to produce the preset level for the selected band.

When the UNLEVELED pushbutton is pressed, Unlevel Switch Q16 conducts, applying a fixed negative voltage of the summing junction for Leveling Amplifier U4.

The Band Select Switching (Q4-Q7, Q11, Q13, and Q15) contains a two-transistor switch for each band. If the band is not selected by the Band Select signals from the Model 551-1 (SP-1046), the associated transistor switch circuit applies a negative Deselect signal to the associated AM Signal Emitter Follower. This causes the emitter follower to produce a negative output which biases off the associated input port of the RF Switch. The transistor switch for the selected band is switched off, allowing the positive AM Signal from Leveling Amplifier U4 to be applied through the associated emitter follower.

The magnitude of the positive signal from the enabled emitter follower is proportional of the rf output level produced by the RF Switch.

Voltage Source U3/Q3 produces a voltage whose level is adjustable by means of potentiometer R19. The nominal output voltage setting is +1 volt. This voltage is applied to the RF Switch, where it is used to smooth the switching transition from one band to another.

5.4.2 YIG-TUNED RF MODULES, DETAILED DESCRIPTION (figure 5-8)

This description applies to the rf modules for the 1 to 4 GHz, 4 to 8 GHz, and 8 to 12.4 GHz frequency bands, figure 5-8 is the detailed block diagram. The diagram applies to all three YIG-tuned rf modules, with the exceptions indicated in notes 1 and 2.

NOTE

In the descriptions that follow, reference designations in paratheses are for the 1 to 4 GHz module. The other reference designations are for the 4 to 8 GHz and 8 to 12.4 GHz modules.

A YIG-tuned oscillator contains a microwave transistor as the active element, and includes a sphere of yttrium-rion-garnet material which functions as a resonant tank circuit for the transistor, and as a coupling device for the rf output energy. Current passing through an electro-magnetic tuning coil produces magnetic flux lines that cause the YIG sphere to act as a classical resonant circuit once the material has been magnetically saturated. The magnitude of the magnetic flux (proportional to the current through the coil) determines the resonant frequency of the YIG sphere, which can be tuned to various frequencies at a constant rate of approximately 2.8 MHz per Gauss. This inherent linearity makes the YIG-tuned oscillator ideal for use in a swept signal source. All electronic circuits required for the oscillator are contained on a YIG driver PCB.

5.4.2.1 SELECT SWITCHING Q6/Q7 (Q4) A high Select signal input causes transistor switch Q6 (Q4) to conduct, removing the high positive (cut-off) bias from the Gunn Bias Regulator. Also, transistor switch Q7 (not included in 1 to 4 GHz module) is cut off, removing the ground from the summing junction of the Input Amplifier.

5.4.2.2 INPUT AMPLIFIER IC3 (U1) The 0 to -10 volt Turning signal and the wide-band Phase Lock signal are summed at the input of this operational amplifier, which has a gain of -1. A 10:1 voltage divider is used for the Phase Lock signal. A log compensation network in the feedback loop compensates for the tuning lag inherent in the magnetic circuit used to tune the oscillator. The Band Stop potentiometer is set to obtain the correct frequency at the high end of the band.

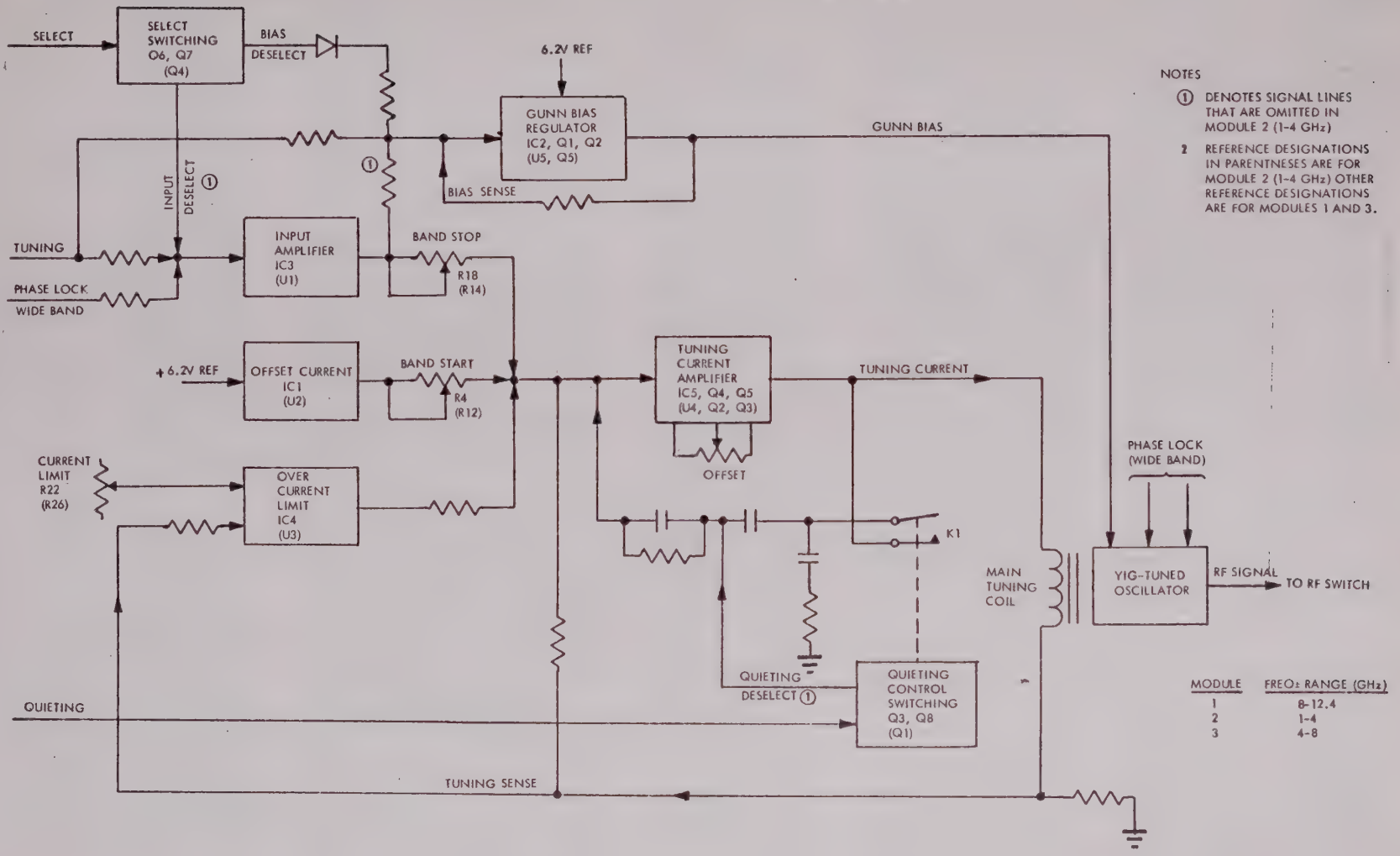


Figure 5-8. YIG-Tuned RF Modules, Block Diagram

5.4.2.3 TUNING CURRENT OFFSET IC1 (U2) A 6.2 volt reference voltage is applied to this amplifier, which serves as a X2 buffer. The Band Start potentiometer is set to obtain the correct frequency at the low end of the band.

5.4.2.4 OVER-CURRENT LIMIT IC4 (U3) The Tuning Sense feedback signal from the tuning coil of the oscillator is supplied to this voltage comparator, whose switching level is set by the Current Limit potentiometer. If the tuning current exceeds the limit established by the Current Limit potentiometer, the voltage comparator changes state and holds the tuning current amplitude at its maximum allowable value. This prevents the oscillator from being overdriven by transients or excessive external wide-band Phase Lock signals.

5.4.2.5 TUNING CURRENT AMPLIFIER IC5/Q4/Q5 (U4/Q2/Q3) The input summing junction for operational amplifier IC5 (U4) receives the outputs of the Input Amplifier, the Tuning Current Offset circuit, and the Over-Current Limit circuit, and also receives the Tuning Sense feedback signal. Transistor amplifiers Q5/Q4 (Q3/Q2) function as a voltage-to-current amplifier that drives the main tuning coil of the oscillator. The amplifier is capable of delivering up to 1 ampere, and operates in a closed loop, since the Tuning Sense signal is returned through a feedback resistor to the summing junction at the input of IC5 (U4).

5.4.2.6 QUIETING CONTROL Q3/Q8 (Q1) A high Quieting signal input turns on transistor switch Q3 (Q1), energizing relay K1 (K1). Also, transistor switch Q8 (not used in 1 to 4 GHz module) is turned off, removing the Quieting Deselect ground from the junction of R35 and C13. With relay K1 energized, capacitor C13 (C8) is connected across the Tuning Current Amplifier. This reduces the tuning current bandwidth of the amplifier, thereby reducing incidental noise and residual FM in the rf output.

5.4.2.7 GUNN BIAS REGULATOR IC2/Q1/Q2 (U5/Q5) A constant-voltage power supply consisting of operational amplifier IC2 (U5), emitter follower Q1 (not used in 1 to 4 GHz module), the pass transistor Q2 (Q5) provides the operating bias voltage for the oscillator. The required bias level is determined by the characteristics of the oscillator being used. A voltage divider sets the feedback level from oscillator. This feedback level is compared in IC2 (U5) to a fixed reference voltage, producing the drive to maintain the optimum bias level for the oscillator. An over voltage crowbar switch consisting of a Zener diode and a silicon-controlled rectifier (SCR) is used to protect the oscillator from damaging transient voltages or overloads. If the bias voltage rises above the Zener diode level, the SCR triggers, short circuiting the base drive for Q1 (Q5). Once the SCR has triggered, the short-circuit remains until power is interrupted.

5.4.2.8 NARROW-BAND PHASE LOCK TUNING INPUT In addition to the main tuning current produced by the YIG driver PCB, an external Phase Lock signal is applied to a secondary tuning coil when the narrow bandwidth is selected. The frequency sensitivity of the oscillator to this tuning current is dependent on oscillator characteristics.

5.4.3 VARACTOR-TUNED RF MODULE (figure 5-9)

This description applies to the 0.5 to 1.0 GHz rf module. Figure 5-9 is a detailed block diagram.

Unlike the YIG-tuned oscillator, the varactor-tuned device is not linear. Hence the linear Tuning input signal must be converted to a non-linear signal whose shape is the inverse of the current vs. frequency response of the oscillator.

5.4.3.1 INPUT AMPLIFIERS IC1/IC2 The 0 to -10 volt Tuning signal and the narrow-band phase lock signal are summed at the input of operational amplifier IC1, which has a gain of -1. A 10:1 voltage divider is used for the Phase Lock signal. The positive voltage from IC1 is applied to the linearizing diode/resistor network, and is also applied to amplifier IC2, which is also an operational amplifier with a gain of -1. The positive voltage from IC2 is also supplied to the linearizing diode/resistor network.

5.4.3.2 LINEARIZING NETWORK AND LINEARIZER AMPLIFIER The linearizing diode/resistor network converts the tuning signal to a non-linear function that is the inverse of the current vs. frequency response of the oscillator. The resulting voltage from this network is applied to a Linearizer Amplifier IC3/Q1/Q2, which performs voltage to current conversion.

5.4.3.3 QUIETING CONTROL Q3/Q4 A high Quieting signal input turns on transistor switch Q3/Q4, switching capacitor C10 across the Linearizer Amplifier. This reduces the tuning bandwidth of the amplifier, thereby reducing incidental noise and residual FM in the rf output.

5.4.3.4 OSCILLATOR POWER CONTROL PCB When the Select line goes high, transistor Q2 conducts, permitting pass transistor Q1 to apply the +30 volt power to the oscillator. When the Select line is low, the +30 volt power is interrupted, disabling the oscillator.

5.4.4 POWER SUPPLY (Refer to Schematic Diagram in Section IX)

The power supply consists of the power transformer, pass transistor assembly, and power supply assembly. Line power is applied to power transformer T1 when the POWER ON/OFF switch is set to ON. Fuse F1 provides ac line protection. Slide switch S1 selects the transformer taps for 115 volt or 230 volt operation. The three highly filtered rectifier circuits in the secondary windings of T1 supply the required dc inputs to the regulator circuits. These voltages are nominally +45, -35, and +250 volts.

The voltage regulators are contained on the power supply assembly, and the associated pass transistors are contained on the pass transistor assembly.

5.4.4.1 +20V SUPPLY Regulation of the +20V supply is achieved by comparison in IC4 of the 6.2V reference produced by CR5 and the divided down +20V Sense input. Resistors R1 and R6 are selected during test to set the output range. The output from IC4 supplies the base drive for Darlington-connected pass transistors Q3 and Q4.

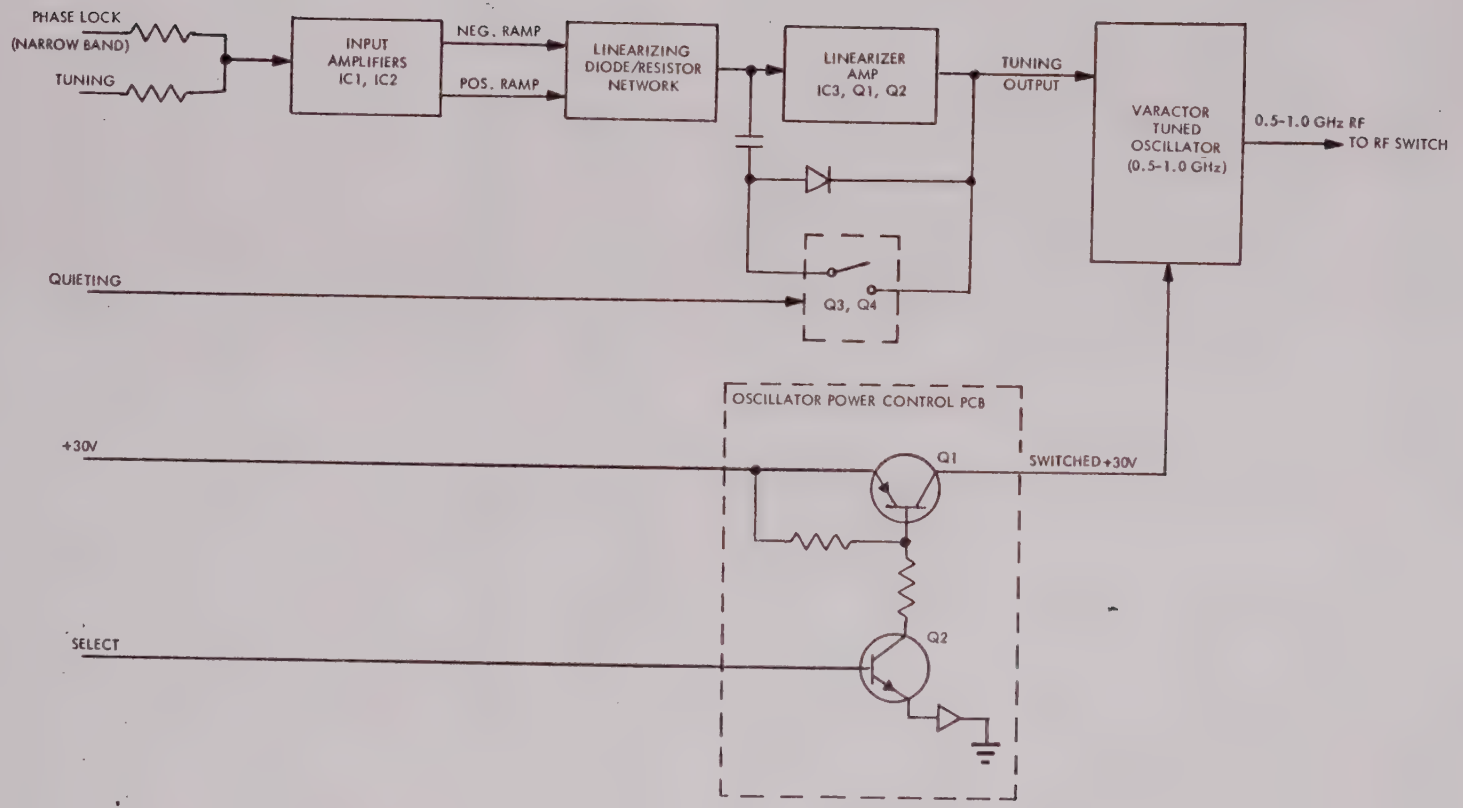


Figure 5-9. Varactor-Tuned RF Module, Block Diagram

Operation of the regulator is best understood by considering a specific change in the output voltage. If, for example, the output voltage drops, the +20V Sense signal will also drop. Since the divided-down +20V Sense signal is an inverting input to IC4, the output of IC4 will rise, allowing more base drive to the pass transistors, which respond by increasing the output voltage.

5.4.4.2 -20V SUPPLY Regulation of the -20V supply is achieved by comparison in IC6 of the 1V Sense input with the summation of the +20V Sense and -20V Sense inputs. This arrangement provides for exact tracking of the +20V and -20V supplies. The -20V Set potentiometer sets equal voltages at pins 2 and 3 of IC6. The output of IC6 supplies the base drive for Darlington-connected pass transistors Q5 and Q6. Regulation occurs in the positive return side of the -2 -20V supply. In addition, transient suppression is provided by diodes CR11 and CR15, over-current protection is provided by Q3, and over-voltage protection is provided by Q4. Q3 and Q4 change the base drive to the pass transistors when an over-voltage or over-current condition exists. Operation of the regulator is similar to that described in paragraph 5.5.1.

5.4.4.3 +30V SUPPLY The +30V regulator also tracks the +20V supply. Regulation is achieved by comparison in IC5 of the +20V Sense input with the +30 Sense input. Q1 provides constant drive to Darlington-connected pass transistors Q1 and Q2. IC5 regulates the output by sinking part of the drive current to pass transistor Q2. The sense voltage never drops below +17V because of diode CR1. Diode CR2 is normally back-biased. Additional protection is provided to IC5 by diode CR4. Transient suppression is provided by CR10 and CR13, over-current protection is provided by Q1, and over-voltage protection is provided by Q2.

5.4.4.4 +15V REGULATOR This regulator consists of constant current source Q2, which is regulated from the +20V line by a 16 volt zener diode, CR6. Additional filtering is provided by capacitor C7.

5.4.4.5 -15V REGULATOR This regulator consists of constant current source Q3, which is regulated from the -20V line by a 16 volt zener diode, CR8. Additional filtering is provided by capacitor C18.

SECTION VI

MAINTENANCE

6.1 GENERAL

This section provides periodic and corrective maintenance instructions for the sweeper system. Also included are complete minimum performance standards checks.

6.2 PERIODIC MAINTENANCE (table 6-1)

Table 6-1 provides periodic maintenance requirements for the sweeper system.

TABLE 6-1. PERIODIC MAINTENANCE REQUIREMENTS

ITEM	FREQUENCY	REQUIREMENTS
Cleaning and Inspection		1. Remove covers and remove dust and foreign material 2. Clean contact fingers of printed circuit boards with a gum eraser. 3. Inspect unit for loose connections, loose controls, loose screws, etc.
Functional Operation Checks		Perform checks in Section 4
Minimum Performance Standards Checks		Perform checks in paragraph 6.3.
Calibration		Perform calibration procedures in Section VII.

6.3 MINIMUM PERFORMANCE STANDARDS CHECK

The minimum performance standards checks in the sub-paragraphs that follow are intended to verify that the sweeper system meets the specification requirements set forth in table 1-1 through 1-3. These checks also provide the basis for troubleshooting.

To prepare the system for the minimum performance checks, perform the procedure in paragraph 2.2, and set up the system for local operation.

Table 6-2 lists the test equipment required for performing the minimum performance standards checks.

TABLE 6-2. TEST EQUIPMENT

TEST EQUIPMENT	ABBREVIATION USED IN TEXT
Digital Voltmeter	DVM
Digital Frequency Counter capable of measuring frequencies in the 0.5 to 12.4 GHz range	DFC
Microwave Power Meter	PM
Microwave Spectrum Analyzer	SA
Dual Trace Oscilloscope	DTO

6.3.1 SWEEP AND MARKER CHECKS (LOCAL OPERATION)

These checks verify that the Model 521 sweep and markers are operational.

Step 1. Make the following control settings on the Model 521:

Control	Setting
BAND SELECT	2
SWEEP MODE	F1-F2
F1-START	1.0 GHz
F2-STOP	4.0 GHz
MARKER 1	2.0 GHz
MARKER 2	3.0 GHz
SWEEP TIME	.01
TRIGGER	INT
MARKERS	OFF
SWEEP TIME VERNIER	X1
MODULATION MODE	CW

Step 2. Connect DTO to outputs 10 through 15 in table 1-3, and verify that each output has the characteristics described in table 1-3.

Step 3. Select Band 1.

Step 4. Set F1-START to 0.5 GHz, and set F2-STOP to 1.0 GHz. Set MARKER 1 to 0.7 GHz, and set MARKER 2 to 0.8 GHz. Depress MARKERS INTEN button. Connect trace 1 of DTO to FREQ VOLTS connector, and connect trace 2 to MARKER OUTPUT connector. Observe that dots appear on trace 1 coincident with marker pulses on trace 2.

Step 5. Connect trace 1 of DTO to pin 46 of REMOTE OUTPUT connector on Model 551-1 (SP-1046). Connect trace 2 of DTO to MARKER OUTPUTS connector. Depress MARKERS AMPL button. Observe that negative-going spikes appear on trace 1 coincident with marker pulses on trace 2.

Step 6. Connect trace 1 of DTO to pin 46 of REMOTE OUTPUT connector on Model 551-1 (SP-1046). Connect trace 2 of DTO to BLANKING OUTPUT connector. Pull out the RETRACE button. Observe that negative-going transition occurs on trace 1 coincident with positive-going transition on trace 2, and that positive-going transition occurs on trace 1 coincident with negative-going transition on trace 2.

Step 7. Connect trace 1 of DTO to SWEEP OUTPUT connector, and connect trace 2 to BLANKING OUTPUT connector. Verify that sweep on trace 1 has a duration of approximately 9 milliseconds, and that blanking pulse on trace 2 has a duration of 1 millisecond. Vary the sweep time VERNIER control from X1 to X10. Observe that sweep time on trace 1 increases from 9 milliseconds to approximately 99 milliseconds. Return the sweep time VERNIER to the X1 position.

Step 8. Depress SWEEP TIME .1 button. Sweep time on trace 1 shall be approximately 90 milliseconds. Retrace time on trace 2 shall be 10 milliseconds.

Step 9. Depress SWEEP TIME 1 button. Sweep time on trace 1 shall be approximately .9 seconds. Retrace time on trace 2 shall be .1 second.

Step 10. Depress SWEEP TIME 10 button. Sweep time on trace 1 shall be approximately 9 seconds. Retrace time on trace 2 shall be 1 second.

Step 11. Depress MANUAL SCAN button, and vary the sweep time VERNIER control from X1 to X10. Voltage on trace 1 shall increase from 0 volt to +10 volt as VERNIER is varied.

Step 12. Depress SWEEP TIME .01 button, and then depress TRIGGER MAN/EXT button. Then, repetitively depress TRIGGER MAN/EXT button approximately once every 2 seconds. A sweep shall be produced on trace 1 each time the button is pressed.

Step 13. Connect an external signal having the characteristics of index No. 3 of table 1-2 to the EXT'L TRIG connector. Connect trace 1 of the DTO to the SWEEP OUTPUT connector, and connect trace 2 to the input being applied to the EXT'L TRIG connector. Observe that sweeps on trace 1 are initiated approximately 3 milliseconds after leading edge of pulses on trace 2.

Step 14. Depress the TRIGGER LINE button. Observe that sweeps on trace 1 are initiated at the ac line frequency rate.

Step 15. Select Band 3, and depress Fc ± ΔF X1, SWEEP MODE button. Set Fc/CW control to 6 GHz, and set F2-STOP -ΔF for maximum frequency excursion. Depress MANUAL SCAN button, and set sweep time VERNIER control to X1.

Step 16. Connect DVM to the FREQ VOLTS connector. Vary sweep time VERNIER control from X1 to X10, and verify that DVM reading changes by 1.000 ± .01 volt between the X1 and X10 positions of the VERNIER control.

Step 17. Depress Fc ± ΔF X.1 SWEEP MODE button. Again vary the sweep time VERNIER control from X1 to X10, and verify that DVM reading changes by 0.100 ± .006 volt between X1 and X10 positions of the VERNIER control.

Step 18. Depress the CW SWEEP MODE button. Observe that DVM varies from 0 to -10 volts as Fc/CW control is varied from one dial extreme to the other. Set Fc/CW control to the approximate center of the band. Then, switch on the ΔF/CW VERNIER control, and vary the control from one extreme to the other. Verify that DVM reading changes by 0.500 ± .05 volts as ΔF/CW VERNIER control is varied.

Step 19. Apply a signal having the characteristics described in index No. 2 of table 1-2 to the EXT'L MOD FM connector, and depress the MODULATION MODE EXT FM button. Vary the input to the EXT'L MOD FM connector over a one-volt range. Verify that a corresponding one-volt variation occurs in the DVM reading.

6.3.2 FREQUENCY CHECKS (LOCAL OPERATION)

These checks verify that the sweeper system produces the correct output frequencies in local operation, and that undesired responses are within tolerance. Also, phase lock operation (wide mode) is checked on bands 2 through 4.

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	
SWEEP MODE	F1-F2
F1-START	0.5 GHz
F2-STOP	1.0 GHz
F/CW VERNIER	OFF
SWEEP TIME	MANUAL SCAN
TRIGGER	INT
MARKERS	OFF
Sweep Time VERNIER	X1
MODULATION MODE	CW (EXT FM pulled out)
SLOPE	Fully counterclockwise
UNLEVELED	depressed
POWER	pulled out and set to mid-range

Step 2. Connect DVM to TRACKING VOLTAGE OUTPUT connector, and connect SA and DFC to RF OUT connector, using appropriate attenuators.

Step 3. Vary the sweep time VERNIER control from X1 to X10. Verify that DVM reading in volts is within ±0.5% of the frequency reading in GHz on the DFC, and that undesired responses (item 19 of table 1-1) are within tolerance.

Step 4. Select Band 2. Set F1-START control to 1.0 GHz, and set F2-STOP control to 4.0 GHz. Repeat step 3.

Step 5. Select Band 3. Set F1-START control to 4.0 GHz, and set F2-STOP control to 8.0 GHz. Repeat step 3.

Step 6. Select Band 4. Set F1-START control to 8.0 GHz, and set F2-STOP control to 12.4 GHz. Repeat step 3.

Step 7. Depress SWEEP MODE CW button. Select Band 1, and set Fc/CW control to center of Band 1. Verify that DFC frequency reading is within ±1% of dial reading.

Step 8. Select Band 2. Record DFC frequency reading, and verify that it is within ±1% of dial reading.

Step 9. Set PHASE LOCK BANDWIDTH switch to WIDE, and connect an input signal having the characteristics of index No. 6 of table 1-2 to the PHASE LOCK connector. Adjust the PHASE LOCK input for +5.00 volts.

Step 10. Observe the frequency reading on the DFC. The frequency shall be approximately 50 MHz less than that recorded in step 8.

Step 11. Disconnect the PHASE LOCK input. Select Band 3, and record the DFC frequency reading. Verify that DFC reading is within ±1% of dial reading.

Step 12. Repeat step 9. The frequency reading on the DFC shall be approximately 50 MHz less than that recorded in step 11.

Step 13. Disconnect the PHASE LOCK input. Select Band 4, and record the DFC frequency reading. Verify that DFC reading is within ±1% of dial reading.

Step 14. Repeat step 9. The frequency reading on the DFC shall be approximately 50 MHz less than that recorded in step 13.

6.3.3 RF OUTPUT POWER CHECKS

These checks verify that control of the rf output power level meets all specifications.

Step 1. Make the following control settings:

Control	Setting
BAND SELECT	1
SWEEP MODE	F1-F2
F1-START	0.5 GHz
F2-STOP	1.0 GHz
SWEEP TIME	MANUAL SCAN
TRIGGER	INT
MARKERS	OFF
Sweep Time VERNIER	X1
MODULATION MODE	CW
SLOPE	fully counterclockwise

Step 2. Connect PM and DFC to RF OUT connector.

Step 3. Depress UNLEVELED button, and pull out POWER button. UNLEVELED WHEN LIT indicator shall be lighted.

Step 4. Adjust sweep time VERNIER control for a frequency reading of 0.5 GHz on DFC. Vary the POWER control from one extreme to the other. The reading on the PM shall change by 40 dB while the POWER control is varied.

Step 5. Turn POWER control fully clockwise (maximum power setting). Vary SLOPE control from one extreme to the other. The reading on the PM shall change by 30 dB while the SLOPE control is varied. Return SLOPE control to fully counterclockwise position. — only works in

Step 6. Depress INTERNAL LEVEL button, and push in POWER button. The UNLEVELED WHEN LIT indicator shall extinguish. Vary the POWER control from one extreme to the other. The reading on the PM shall change from 0 mW to 10 mW while the POWER control is being varied. Set the POWER control to a mid-range setting, and record the reading on the PM.

Step 7. Turn sweep time VERNIER control to vary the DFC frequency reading from 0.5 GHz to 1.0 GHz while observing the reading on the PM. The reading shall not vary by more than ±1 dB from the reading recorded in step 6.

Step 8. Select Band 2, Set F1-START control to 1.0 GHz, and set F2-STOP control to 4.0 GHz. Turn sweep time VERNIER control to vary the DFC frequency reading from 1.0 GHz to 4.0 GHz, while observing the reading on the PM. The reading shall not vary by more than ±1 dB from the reading recorded in step 6.

Step 9. Select Band 3. Set F1-START control to 4.0 GHz, and set F2-STOP control to 8.0 GHz. Turn sweep time VERNIER control to vary the DFC frequency reading from 4.0 GHz to 8.0 GHz, while observing the reading on the PM. The reading shall not vary by more than ±1 dB from the reading recorded in step 6.

Step 10. Select Band 4. Set F1-START control to 8.0 GHz, and set F2-STOP control to 12.4 GHz. Turn sweep time VERNIER control to vary the DFC frequency reading from 8.0 GHz to 12.4 GHz, while observing the reading on the PM. The reading shall not vary by more than ±1 dB from the reading in step 6. With sweep time VERNIER set for a DFC frequency reading of 12.4 GHz, vary SLOPE control from one extreme to the other. There shall be no change in the PM reading.

Step 11. Select BAnd 3, and set Fc/CW control for 6.0 GHz. Depress SWEEP MODE CW button. Depress MODULATION MODE 1 KHz button. Verify presence of 1 KHz signal at 1 KHz output connector. Connect SA to RF OUT connector. Use SA to verify pressure of 100% 1 KHz modulation of 6.0 GHz carrier.

Step 12. Connect an input signal having the characteristics of index No. 1 of table 1-2 to the EXT'L MOD AM connector, and press MODULATION MODE EXT AM button. Use SA to verify that external AM input has a modulation sensitivity of -.1V/mW.

6.3.4 REMOTE OPERATION AND TRACKING VOLTAGE CHECKS

These checks verify that the sweeper system operates correctly in the remote mode. Install the Model 9140 Remote Input Plug in the REMOTE INPUT connector of the Model 551-1 (SP-1046), and connect the remote control unit to the Model 9140 Remote Input Plug.

Step 1. Connect DVM to TRACKING VOLTAGE OUTPUT connector. Connect DFC to RF out connector.

Step 2. At remote control unit, set digital frequency to 1.0% (0000 0001 0000).

Step 3. At remote control unit, select bands 1 through 4, and verify that DVM and DFC readings are within the following tolerances:

Band	DVM Reading (±10mV)	DFC Reading (±5%)
1	+0.470V	.47 GHz
2	+1.000V	1.0 GHz
3	+3.900V	3.9 GHz
4	+7.900V	7.9 GHz

Step 4. At remote control unit, set digital frequency to 99.0% (1001 1001 0000).

Step 5. At remote control unit, select bands 1 through 4, and verify that DVM and DFC readings are the following tolerances:

Band	DVM Reading (±10mV)	DFC Reading (±5%)
1	+1.030V	1.03 GHz
2	+4.000V	4.0 GHz
3	+8.100V	8.1 GHz
4	+12.500V	12.5 GHz

Step 6. Connect DVM to pin 42 of REMOTE OUTPUT connector.

Step 7. At remote control unit, set in the following digital frequency values, and verify that the DVM reading is within ±10mV of the following values:

Digital Frequency	DVM Reading
.1%	-.0100V
.2%	-.0200V
.4%	-.0400V
.8%	-.0800V
1%	-.1000V
2%	-.2000V
4%	-.4000V
8%	-.8000V
10%	-1.000V
20%	-2.000V
40%	-4.000V
80%	-8.000V

Step 8. At remote control unit, set digital frequency to 0.0%, and connect an input having the characteristics of index No. 4 of table 1-2 to the REMOTE FM IN connector. Set the REMOTE FM IN signal to +1 volt. The DVM reading shall be -2.45V ±10mV.

6.4 TROUBLESHOOTING

When the system malfunctions, the possibility of a power supply failure should first be eliminated. Perform the power supply voltage checks in Section VII. If the power supply voltages are normal, attempt to correct the malfunction by recalibration, referring to Section VII for calibration instructions. If recalibration fails to correct the malfunction, refer to table 6-3 for additional troubleshooting.

TABLE 6-3. TROUBLESHOOTING

ITEM NO.	SYMPTONS	FAULT ISOLATION
1	Abnormal indications in the procedure in paragraph 6.3.1 (Sweep and Marker Checks)	Fault is in Model 521, module A2, A3, or A4. Analyze specific symptoms, using theory of operation and block diagrams to identify the most probable defective module.
2	Abnormal rf output in a single band noted in the procedure of paragraph 6.3.2 (Frequency Checks)	Corresponding rf module in Model 525 is defective, or rf switch in Model 525 is defective.

TABLE 6-3. TROUBLESHOOTING (Con't)

ITEM NO.	SYMPTOMS	FAULT ISOLATION
3	Frequency Checks in paragraph 6.3.2 are normal, but Remote Operation and Tracking Voltage Checks in paragraph 6.3.4 are abnormal.	D/A converter on board A1 of Model 551-1 (SP-1046) is defective.
4	Abnormal rf output noted in all four bands while performing the procedure of paragraph 6.3.2 (Frequency Checks. Rf output is normal in all bands while performing Remote Operation and Tracking Voltage Checks in paragraph 6.3.4.	Fault is in Model 521. Check module A3.
5	Rf output frequency is correct in steps 7 through 13 of paragraph 6.3.2, but tracking voltage is incorrect in steps 3 through 6. Incorrect tracking voltages are also noted in the procedure of paragraph 6.3.4.	Fault is in tracking voltage generator on board A2 of Model 551-1 (SP-1046).
6	Rf output is abnormal in more than one band while performing the procedures of paragraphs 6.3.2, 6.3.3, and 6.3.4.	1. Turn SLOPE control fully counterclockwise, and depress the CW MODULATION MODE button. 2. Pull out the POWER control. 3. Connect DVM to pin 46 of REMOTE OUTPUT connector. 4. Vary POWER control from one extreme to the other. The DVM reading shall vary from -0.6V to +2V between the two extremes of the POWER control. If voltage is correct, proceed to step 5. If voltage is incorrect, proceed to step 6. 5. Fault is in Model 525. Check AM PCB, rf switch, and directional coupler.

TABLE 6-3. TROUBLESHOOTING (Con't)

ITEM NO.	SYMPTOMS	FAULT ISOLATION
6 (Con't)		6. Connect DVM to pin B29 of plug-in connector J17 on Model 521. Vary POWER control from one extreme to the other. The DVM reading shall vary from 0V to +2V between the two extremes of the POWER control. If voltage is normal, fault is in AM/Slope Amplifier on board A2 of Model 551-1 (SP-1046). If voltage is abnormal, fault is in module A5 of Model 521.
7	UNLEVELED WHEN LIT indicator fails to light in step 3 of paragraph 6.3.3.	Fault is in AM PCB of Model 525.
8	Abnormal indication in step 4 of paragraph 6.3.3.	Perform the procedure given for item 6.
9	Abnormal indication in step 5 of paragraph 6.3.3.	Fault is in Model 551-1 (SP-1046). Check SLOPE control potentiometer, slope control relay, and AM/Slope Amplifier on board A2.
10	Abnormal indication in step 6 of paragraph 6.3.3.	Fault is in Model 525. Check AM PCB.
11	Abnormal indications in steps 7 through 10 of paragraph 6.3.3.	Fault is in Model 525. Check leveling control PCB, directional coupler, AM PCB, and rf switch. If abnormal indications are in a single band, check rf module.
12	Abnormal indication in step 11 or 12 of paragraph 6.3.3.	Fault is in module A5 of Model 521.

SECTION VII

CALIBRATION

7.1 GENERAL (figures 7-1 through 7-3)

This section contains complete calibration instructions for the sweeper system. The test equipment requirements are given in table 6-2. Figures 7-1 through 7-3 show the locations of test points and adjustments.

For a complete calibration of the system, perform the procedures in the sequence given.

7.2 VOLTAGE CHECKS (figures 7-1 and 7-3)

Power supplies are contained in the Model 521 and the Model 525. Perform the procedure in paragraph 2.2 to apply power. Then, make the following voltage checks:

Unit	Supply Voltage	Test Points From	Test Points To	Tolerance	Adjustment
Model 521	+15 Volts	A1~~TP2~~ TP3 (+)	A1~~TP1~~ TP2 (-)	±0.015V	A1R26
Model 521	-15 Volts	A1~~TP3~~ TP4 (-)	A1~~TP1~~ TP2 (+)	±0.015V	A1R36
Model 521	+5 Volts	A1~~TP4~~ TP1 (+)	A1~~TP1~~ TP2 (-)	±0.05V	A1R10
Model 525	+30 Volts	A4TP1 (+)	A4TP2 (-)	±0.1V	A5R17
Model 525	+20 Volts	A4TP3 (+)	A4TP2 (-)	±0.02V	A5R4
Model 525	-20 Volts	A4TP4 (-)	A4TP2 (+)	±0.02V	A5R23
Model 525	+250 Volts	A4 Pin C (+)	A4TP2 (-)	±10V	None

7.3 MODEL 521 ADJUSTMENTS (figure 7-1)

7.3.1 SWEEP GENERATOR ADJUSTMENTS

All adjustments on the Sweep Generator (A2) are accessible with the bottom cover removed. Proceed as follows:

Step 1. Make the following control settings:

Control	Setting
SWEEP MODE	F1-F2
SWEEP TIME	.01
Sweep Time VERNIER	Mid-range setting
TRIGGER	INT
MARKERS	OFF

Step 2. Connect DVM to SWEEP OUTPUT connector. Adjust A2R6 for 0V ±40 mV.

Step 3. Connect DTO to SWEEP OUTPUT connector. Adjust A2R28 so that maximum positive value of voltage ramp is 10 ±.04 volts.

Step 4. Depress MANUAL SCAN, and rotate sweep time VERNIER control fully counterclockwise. Connect DVM to SWEEP OUTPUT connector. Adjust A2R24 for 0V ±40 mV.

Step 5. Rotate sweep time VERNIER control fully clockwise. Adjust A2R12 for 10 ±.04 volts.

7.3.2 DIAL ADJUSTMENTS

Step 1. Set ΔF/CW VERNIER to OFF, and depress the CW SWEEP MODE button. Connect DVM to Freq VOLTS connector. Turn MARKER 1 - Fc/CW control fully counterclockwise. The DVM reading shall be 0V ±40 mV. Turn MARKER 1 - Fc/CW control fully clockwise. The DVM reading shall be 10 ±.04 volts. If voltages are incorrect, adjust dial mechanism.

Step 2. Depress the F1-F2 SWEEP MODE button. Turn F1-START control fully counterclockwise. The DVM reading shall be 0V ±40 mV. Turn F1-START control fully clockwise. The DVM reading shall be 10 ±.04 volts. If voltages are incorrect, adjust dial mechanism.

Step 3. Depress MANUAL SCAN and TRIGGER INT buttons, and rotate the sweep time VERNIER control fully clockwise. Turn F2-STOP - ΔF control fully counterclockwise. The DVM reading shall be 0V ±40 mV. Turn F2-STOP - ΔF control fully clockwise. The DVM reading shall be 10 ±.04 volts. If voltages are incorrect, adjust dial mechanism.

Step 4. Depress CW SWEEP MODE button, and set the F2-STOP - ΔF control to the last mark on the right-hand end of the dial. Turn the MARKER 1 Fc/CW control to obtain a DVM reading of 1.000 volts. Depress the Fc ± ΔFX1 SWEEP MODE button. Turn the sweep time VERNIER control fully counterclockwise. The DVM reading shall be -0.500 ±0.005 volts. Turn the sweep time VERNIER control fully clockwise. The DVM reading shall be -1.500 ±0.005 volts. If voltages are incorrect, the value of resistor A3R14 must be changed.

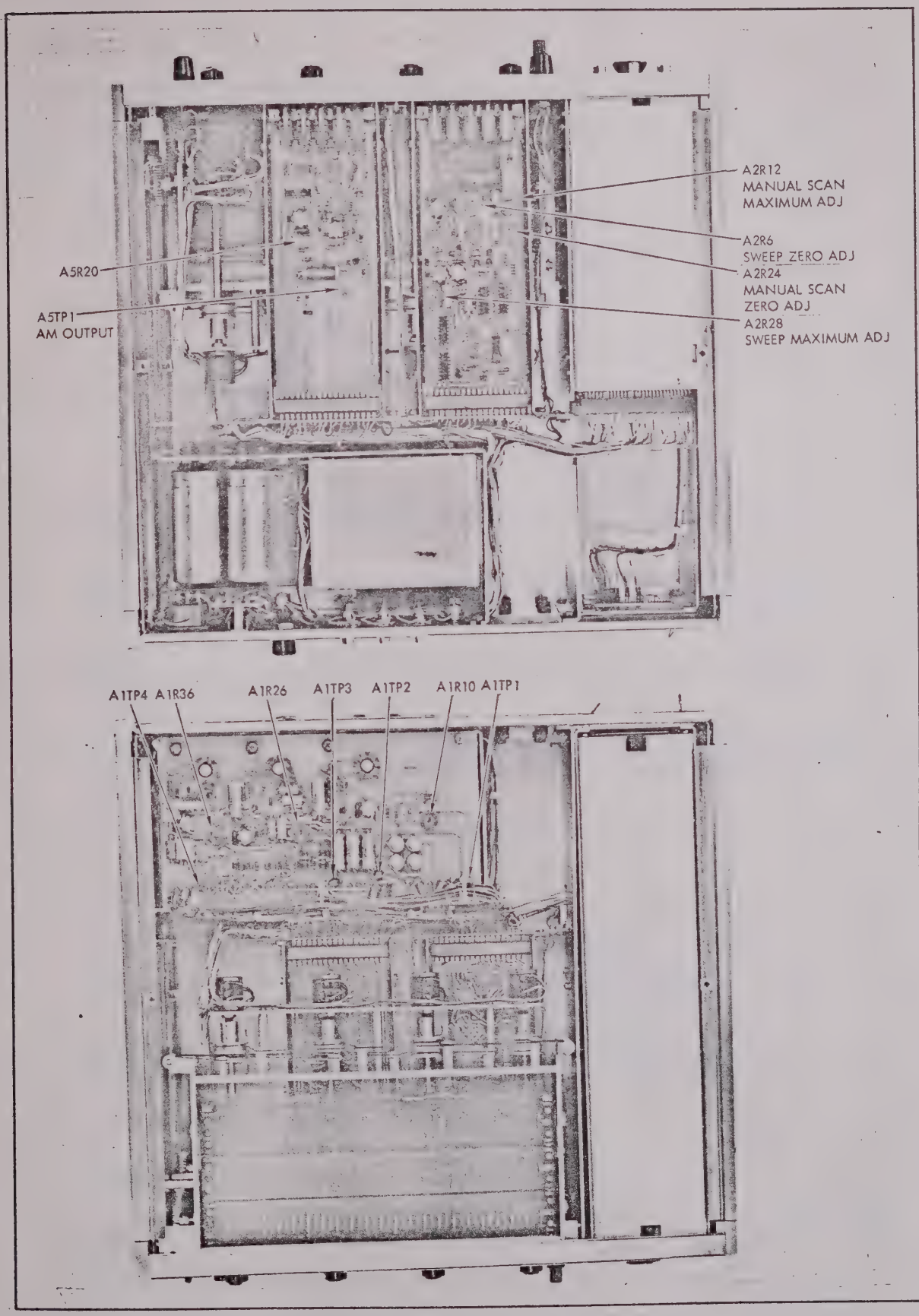


Figure 7-1. Model 521, Test Points and Adjustments

7.3.3 MODULATION AND MARKER ADJUSTMENTS

All adjustments on the AM board are accessible with the bottom cover removed. Proceed as follows:

Step 1. Make the following control settings:

Control	Setting
SWEEP MODE	F1-F2
SWEEP TIME	.01
Sweep Time VERNIER	fully clockwise
TRIGGER	INT
MARKERS	OFF
RETRACE	Depressed
MODULATION MODE	CW
POWER	Pushed in and fully clockwise

Step 2. Connect DVM to A5TP1, and adjust A5R20 for a DVM reading of +0.67 ±0.03 volts.

Step 3. Connect DFC to 1 KHz OUTPUT connector, and adjust rear panel 1 KHz FREQ ADJ for a 1 KHz output. (Press 1KHz MODE)

Step 4. Connect oscilloscope to A5RP1, and depress the AMPL MARKERS button. Adjust rear panel AMPLITUDE MARKER ADJUST for a negative marker pip of at least -0.1 volts.

Step 5. Connect DTO to FREQ VOLTS connector, and depress INTEN MARKERS button. Adjust rear panel INTENSITY MARKER TIME ADJUST for bright dots on the oscilloscope trace.

7.4 MODEL 551-1 (SP-1046) ADJUSTMENTS (figure 7-2)

7.4.1 D/A CONVERTER ADJUSTMENTS

Step 1. Connect Model 9140 Remote Input plug to REMOTE INPUT connector.

Step 2. Connect DVM to pin 42 (49) of REMOTE OUTPUT (INPUT) connector. Adjust A1R5 for a DVM reading of 0 volts. (Ground 17-24 + 42-45)

Step 3. Ground pins 42, 45, 46, 49, 17, 20 and ±21, 24 of Model 9140 Remote Input Plug. Adjust A1R6 for a DVM reading of -9.99 volts.

7.4.2 BAND SCALING AND SLOPE ZERO ADJUSTMENTS

Step 1. Connect Model 9140 Remote Input Plug to REMOTE INPUT connector.

Step 2. Connect DVM to TRACKING VOLTAGE OUTPUT connector. (1V/GHz)

Step 3. Ground pin 24 of Model 9140 Remote Input Plug. (1% range)

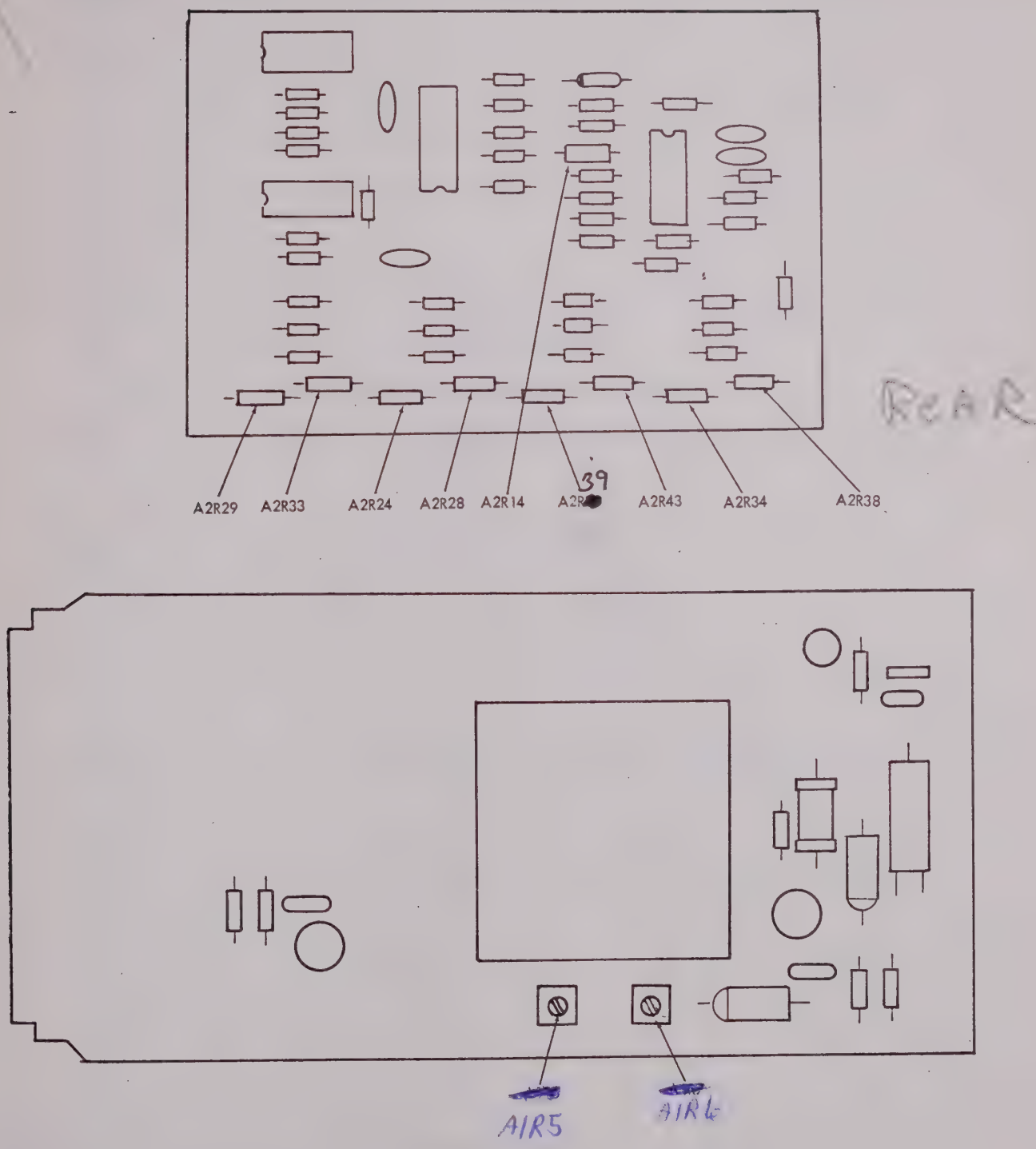


Figure 7-2. Model 551-1 (SP-1046), Adjustments

Step 4. Ground pin 1 (Band 1 select) of Model 9140 Remote Input Plug.

Step 5. Adjust A2R39 for a DVM reading of +0.470V.

Step 6. Ground pins 17, 20, and 21 of Model 9140 Remote Input Plug.

Step 7. Adjust A2R43 for a DVM reading of +1.030V.

Step 8. Remove the grounds from pins 17, 20, and 21 of Model 9140 Remote Input Plug.

Step 9. Repeat steps 5, 6, and 7.

Step 10. Repeat step 8. Remove ground from pin 1 of Model 9140 Remote Input Plug, and ground pin 2 (Band 2 select).

Step 11. Adjust A2R34 for a DVM reading of +1.000V.

Step 12. Repeat step 6, and adjust A2R38 for a DVM reading of +4.000V.

Step 13. Repeat steps 8, 11 and 12.

Step 14. Repeat step 8. Remove ground from pin 2 of Model 9140 Remote Input Plug, and ground pin 3 (Band 3 select).

Step 15. Adjust A2R29 for a DVM reading of +3.900V.

Step 16. Repeat step 6, and adjust A2R33 for a DVM reading of +8.100V.

Step 17. Repeat steps 8, 15, and 16.

Step 18. Repeat step 8. Remove ground from pin 3 of Model 9140 Remote Input Plug, and ground pin 4 (Band 4 select).

Step 19. Adjust A2R24 for a DVM reading of +7.900V.

Step 20. Repeat step 6, and adjust A2R28 for a DVM reading of +12.500V.

Step 21. Repeat steps 8, 19, and 20.

Step 22. Connect DVM to pin E17 of A2. Adjust A2R14 for a 0V reading on the DVM.

Step 23. Remove all test connections.

7.5 MODEL 525 ADJUSTMENTS (figure 7-3)

Set up the system to operate in the local mode.

7.5.1 YIG DRIVER ADJUSTMENTS (BANDS 2 THROUGH 4)

Modules 3 (Band 3), 2 (Band 2) and 1 (Band 4) each contain Band Start, Band Stop, and Current Limit adjustments. The Current Limit adjustment (R22 for

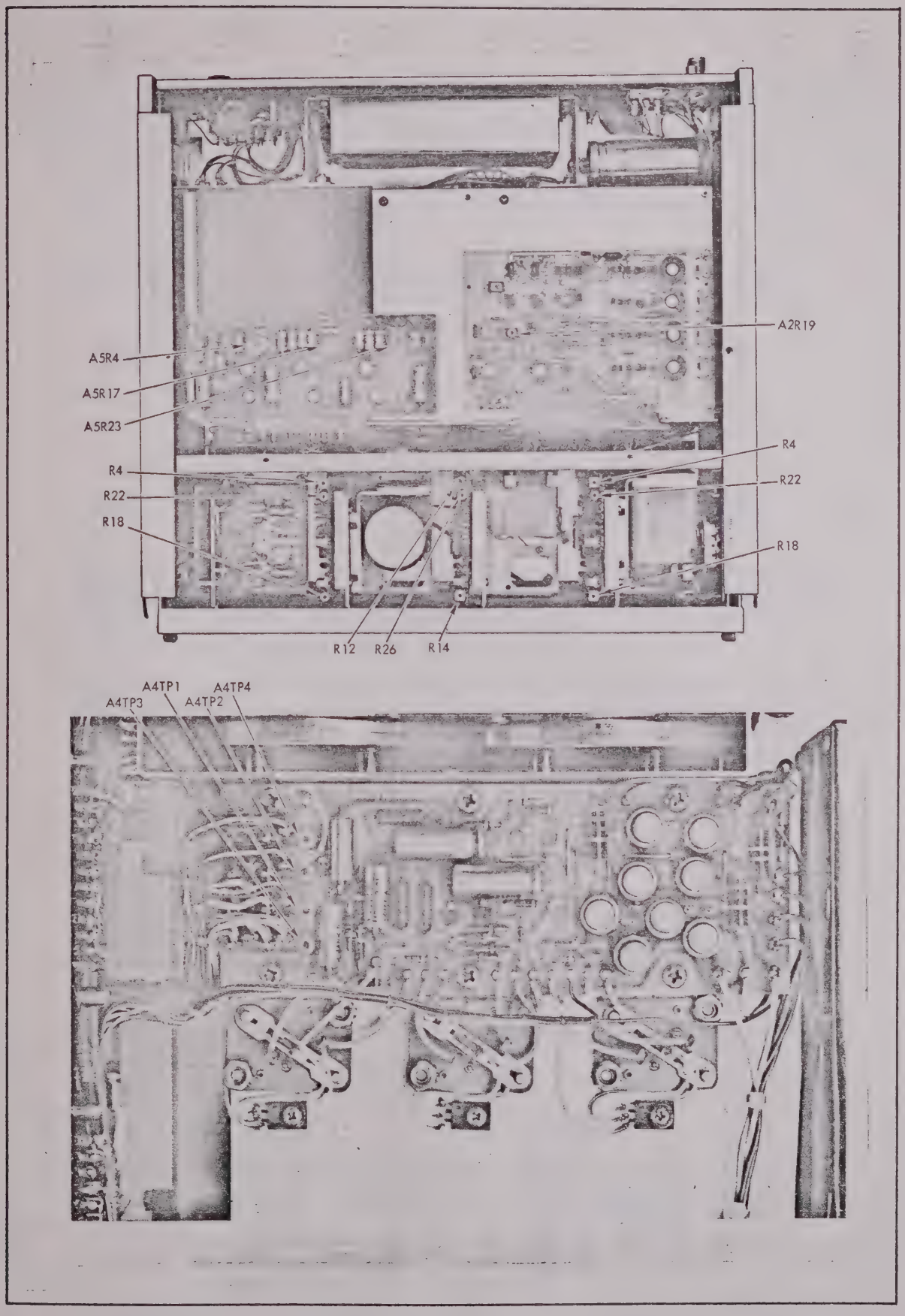


Figure 7-3. Model 525, Test Points and Adjustments

modules 3 and 1, R26 for module 2) is pre-set at the factory, and normally requires adjustment only when current limiting is curring before the maximum frequency is reached, as indicated by an inability to tune to the highest frequency in the band, even after adjusting the Band Stop adjustment. Proceed as follows:

Step 1. Connect DVM to TRACKING VOLTAGE OUTPUT connector, and connect DFC to RF OUT connector.

Step 2. On the Model 521, make the following control settings:

Control	Setting
SWEEP MODE	F1-F2
SWEEP TIME	MANUAL SCAN
MARKERS	OFF
F1-START	Fully counterclockwise
F2-STOP	Fully clockwise
MODULATION MODE	CW
POWER	Pulled out and fully clockwise
BAND SELECT	Band being adjusted

Step 3. Adjust sweep time VERNIER control to obtain the Band Start DVM reading indicated in table 7-1 for the band being adjusted. Then, adjust the Band Start Adjust indicated in table 7-1 to obtain the Band Start DFC frequency reading indicated in table 7-1.

Step 4. Adjust sweep time VERNIER control to obtain the Band Stop DVM reading indicated in table 7-1 for the band being adjusted. Then, adjust the Band Stop Adjust indicated in table 7-1 to obtain the Band Stop DFC frequency reading indicated in table 7-1. If required Band Stop frequency cannot be obtained, readjust Current Limit Adjust indicated in table 7-1 until Band Stop frequency can be obtained by adjusting Band Stop Adjust.

7.5.2 RF SWITCH/MODULATOR BIAS VOLTAGE ADJUSTMENT

Step 1. Connect the RF OUT connector to the input of a crystal detector. Connect the crystal detector output to an oscilloscope to permit a display of the power curve across the swept frequency range.

Step 2. Turn bias voltage control A2R19 on AM PCB fully clockwise.

Step 3. On the Model 521, make the following control settings:

Control	Setting
SWEEP MODE	F1-F2
F1-START	Fully counterclockwise
F2-STOP	Fully clockwise
SWEEP TIME	.1
MODULATION MODE	CW
MARKERS	OFF

TABLE 7-1. BAND START/STOP ADJUSTMENTS

BAND	MODULE NO.	BAND START DVM READING	BAND START ADJUST	BAND START FREQUENCY	BAND STOP DVM READING	BAND STOP ADJUST	BAND STOP FREQUENCY	CURRENT LIMIT ADJUST
2	2	+1.000V	R12	1.000 GHz	+4.000V	R14	4.000 GHz	R26
3	3	+3.900V	R4	3.900 GHz	+8.100V	R18	8.100 GHz	R22
4	1	+7.900V	R4	7.900 GHz	+12.500V	R18	12.500 GHz	R22

Step 3. (Con't)

Control	Setting
POWER	Pulled out and fully clockwise
BAND SELECT	2
TRIGGER	INT

Step 4. Depress UNLEVELED button. Adjust the oscilloscope to obtain a display of the power curve across the swept frequency range.

Step 5. Turn bias voltage control A2R19 on AM PCB counter-clockwise until power just begins to decrease, then turn the control slightly clockwise until full power is again attained.

SECTION VIII

PARTS LIST

8.1 INTRODUCTION

This section lists replaceable parts for the Model 50525 (SP-1048) Broadband Sweeper System. Parts are listed in three tables, one for each major component:

Multiband Controller
Computer Interface Plug-In
RF Signal Source

Parts are listed in each table in sequence by reference designation.

PARTS LIST - MULTIBAND CONTROLLER

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
A1	950443			PCB, POWER SUPPLY	1
A1, C1, C2	152410	TE 1307	Sprague	CAP, ELECTROLYTIC, 50uf, 50V	6
A1C3	155470	DM15-270J	Arco	CAP, MICA, 27pf, 500V	3
A1C4	157005	192P1049R8	Sprague	CAP, MYLAR, .1uf, 80V	4
A1C5, C6				Same as A1C1	
A1C7				Same as A1C3	
A1C8				Same as A1C1	
A1C9, C10				Same as A1C4	
A1C11				Same as A1C1	
A1C12				Same as A1C3	
A1C13				Same as A1C4	
A1C14	150100	TGS10	Sprague	CAP, CER DISC, .01uf, 100V	1
A1CR1 thru CR4	480033	1N4997 (MR1030B)	Motorola	DIODE	4
A1CR5 thru CR9	480003	1N4005	Dickson	DIODE	12
A1CR10	480011	1N827	IRC	DIODE, 6.2V	1
A1CR11 thru CR14				Same as A1CR5	
A1CR15	480041	1N5232	Motorola	DIODE, 5.6V	1
A1CR16, CR17	480004	1N4446	Fairchild	DIODE	2
A1CR18, CR19, CR20				Same as A1CR5	
A1IC1, IC2, IC3	480655	LM301AH	National	IC	3
A1K1	450008	Series 70	Sigma	RELAY	1
A1Q1	485011	MJE3055	Motorola	TRANSISTOR	3
A1Q2	485004	2N2102	RCA	TRANSISTOR	3
A1Q3	485006	2N3391	GE	TRANSISTOR	6
A1Q4				Same as A1Q1	
A1Q5				Same as A1Q2	
A1Q6				Same as A1Q3	
A1Q7				Same as A1Q1	
A1Q8				Same as A1Q3	
A1Q9				Same as A1Q2	
A1Q10, Q11, Q12				Same as A1Q3	
A1R1	471468	RL07S333G		RES, MF, 33K, 1/4W, 2%	4
A1R2	471408	RL07S101G		RES, MF, 100 OHM, 1/4W, 2%	3
A1R3	471432	RL07S102G		RES, MF, 1K, 1/4W, 2%	3
A1R4	471423	RL07S431G		RES, MF, 430 OHM, 1/4W, 2%	1
A1R5	471448	RL07S472G		RES, MF, 4.7K, 1/4W, 2%	4
A1R6	477020			RES, WW, .1 OHM, 2.5W, 3%	1
A1R7	471470	RL07S393G		RES, MF, 39K, 1/4W, 2%	1
A1R8	471459	RL07S133G		RES, MF, 13K, 1/4W, 2%	1
A1R9				Same as A1R1	
A1R10	479562	U-201R103B	CTS	POT, 10K, PC MTG	3
A1R11	471480	RL07S104G		RES, MF, 100K, 1/4W, 2%	3
A1R12	475880			RES, FIXED COMP, 100K, 1W, 10%	2
A1R13	472223	RL07S222G		RES, MF, 2.2K, 1/2W, 2%	1
A1R14				Same as A1R1	
A1R15	471446	RL07S392G		RES, MF, 3.9K, 1/4W, 2%	1
A1R16				Same as A1R2	
A1R17	477000	RS1A	Dale	RES, WW, .5 OHM, 1W, 5%	2
A1R18	471421	RL07S361G		RES, MF, 360 OHM, 1/4W, 2%	2
A1R19				Same as A1R3	
A1R20	471460	RL07S153G		RES, MF, 15K, 1/4W, 2%	2
A1R21	471434	RL07S122G		RES, MF, 1.2K, 1/4W, 2%	1
A1R22	471433	RL07S112G		RES, MF, 1.1K, 1/4W, 2%	1
A1R23	476971	RS1/4	Dale	RES, WW, 1.73K, 1/4W, 1%	1
A1R24	476560			RES, WW, 2.5K, 1/4W, .1%	1
A1R25	471473	RL07S513G		RES, MF, 51K, 1/4W, 2%	2
A1R26				Same as A1R10	
A1R27				Same as A1R25	
A1R28				Same as A1R1	
A1R29				Same as A1R17	
A1R30				Same as A1R2	
A1R31				Same as A1R18	

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
A1R32				Same as A1R3	
A1R33, R34	476983	BA6	K&F	RES, WW, 5K, 1/4W, 1%	2
A1R35				Same as A1R11	
A1R36				Same as A1R10	
A1R37				Same as A1R11	
A1R38				Same as A1R20	
A1R39				Same as A1R12	
A1R40, R41				RES (Select at test)	2
A1XK1	450010	AD-67	Sigma	SOCKET, RELAY	1
A2	950436			PCB, SWEEP GENERATOR	1
A2C1	155470	DM15-270J	Arco	CAP, MICA, 27pf, 500V	1
A2C2	157800	212 A1C 103J	Electro Cube	CAP, METALIZED MYLAR, .01 uf, 200V	1
A2C3	157801	212 A1C 104J	Electro Cube	CAP, METALIZED MYLAR, .1 uf, 200V	1
A2C4	157802	212 A1C 105J	Electro Cube	CAP, METALIZED MYLAR, 1 uf, 100V	1
A2C5	157803	212 A1B 106J	Electro Cube	CAP, METALIZED MYLAR, 10 uf, 100V	1
A2C6	154003	196D226X0025PE3	Spague	CAP, TANT, 22 uf, 25V	1
A2C7	150102	TGP10(33C41B6)	Spague	CAP, CER DISC, .1 uf, 100V	1
A2CR1 thru CR7	480004	1N4446	Fairchild	DIODE	7
A2CR8, CR9	480016	1N5228	Motorola	DIODE, 3.9V	2
A2IC1, IC2, IC3	480655	LM301AH	National	IC	3
A2IC4	480664	SN7474N	Motorola	IC	1
A2IC5	480665	SP370	Signetics	IC	1
A2IC6	480662	SN7410N	Motorola	IC	1
A2IC7	480661	SN7400	Motorola	IC	1
A2IC8, IC9	480668	SN7412IN	TI	IC	2
A2Q1	485040	2N5087	Motorola	TRANSISTOR	2
A2Q2, Q3, Q4	485006	2N3391	GE	TRANSISTOR	4
A2Q5				Same as A2Q1	
A2Q6				Same as A2Q2	
A2S1, S5	510079	5XF12.5STD ( )2UGR	IEE-Wes	SWITCH ASSY, PUSHBUTTON	1
A2R1	475683			RES, FIXED COMP, 1.8M, 1/4W, 10%	1
A2R2	471480	RL07S104G		RES, MF, 100K, 1/4W, 2%	1
A2R3	471464	RL07S223G		RES, MF, 22K, 1/4W, 2%	2
A2R4	471460	RL07S153G		RES, MF, 15K, 1/4W, 2%	2
A2R5	471449	RL07S512G		RES, MF, 5.1K, 1/4W, 2%	1
A2R6	479561	U-201R102B	CTS	POT, 1K	3
A2R7	479562	U-201R103B	CTS	POT, 10K	1
A2R8	475655	RC07GF274K		RES, FIXED COMP, 270K, 1/4W, 10%	1
A2R9	471432	RL07S102G		RES, MF, 1K, 1/4W, 2%	4
A2R10	471414	RL07S181G		RES, MF, 180 OHM, 1/4W, 2%	1
A2R11	475677	RC07GF824K		RES, FIXED COMP, 820K, 1/4W, 10%	1
A2R12	479563	U-201R104B	CTS	POT, 100K	1
A2R13	470040			RES, MF, 1.33M, 1/4W, 1%	1
A2R14	471448	RL07S472G		RES, MF, 4.7K, 1/4W, 2%	4
A2R15				Same as A2R9	
A2R16, R17				Same as A2R14	
A2R18	471416	RL07S221G		RES, MF, 220 OHM, 1/4W, 2%	2
A2R19	471423	RL07S431G		RES, MF, 430 OHM, 1/4W, 2%	1
A2R20				Same as A2R9	
A2R21				Same as A2R3	

PARTS LIST - MULTIBAND CONTROLLER (CONT)

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
A2R22				Same as A2R9	
A2R24				Same as A2R6	
A2R25	471455	RL07S912G		RES, MF, 9.1K, 1/4W, 2%	1
A2R26	471433	RL07S112G		RES, MF, 1.1K, 1/4W, 2%	1
A2R27	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	1
A2R28				Same as A2R6	
A2R29	471463	RL07S203G		RES, MF, 20K, 1/4W, 2%	1
A2R30				Same as A2R4	
A2R32, R33	471470	RL07S393G		RES, MF, 39K, 1/4W, 2%	2
A2R34				Same as A2R18	
A2R36	471452	RL07S682G		RES, MF, 6.8K, 1/4W, 2%	1
A2R37				Same as A2R14	
A3	950437			PCB, MODE GENERATOR	1
A3C1	155470	DM15-270J	Arco	CAP, MICA DIP, 27 pf, 500V	6
A3C2	150100	TGS10	Sprague	CAP, CER DISC, .01 uf, 100V	12
A3C3	157002	192P1039R8	Sprague	CAP, MYLAR, .01 uf, 80V	6
A3C4				Same as A3C2	
A3C5				Same as A3C1	
A3C6				Same as A3C2	
A3C7				Same as A3C3	
A3C8				Same as A3C2	
A3C9				Same as A3C1	
A3C10				Same as A3C2	
A3C11				Same as A3C3	
A3C12				Same as A3C2	
A3C13	157005	192P1049R8	Sprague	CAP, MYLAR, .1 uf, 80V	1
A3C14				Same as A3C1	
A3C15				Same as A3C2	
A3C16	155508	DM15-221J	Arco	CAP, MICA DIP, 220 pf, 500V	1
A3C17				Same as A3C3	
A3C18				Same as A3C2	
A3C19	155500	DM15-151J	Arco	CAP, MICA DIP, 150 pf, 500V	1
A3C20	155530	DM15-681J	Arco	CAP, MICA DIP, 680 pf, 500V	1
A3C21				Same as A3C3	
A3C22				Same as A3C1	
A3C23, C24				Same as A3C2	
A3C25				Same as A3C3	
A3C26				Same as A3C1	
A3C27, C28				Same as A3C2	
A3CR1	480037	STB567	GE	DIODE	1
A3IC1 thru IC6	480655	LM301AH	National	IC	6
A3Q1	485004	2N2102	RCA	TRANSISTOR	1
	480752	BHS-5 TO-5	Birnbach	PAD, TRANSISTOR	1
A3R1	476565	BA6	K&F	RES, WW, 25K, 1/4W, .1%	11
A3R2	475686			RES, COMP, 3.9M, 1/4W, 10%	2
A3R3				Same as A3R1	
A3R4	475679			RES, COMP, 1.2M, 1/4W, 10%	1
A3R5	471458	RL07S123G		RES, MF, 12K, 1/4W, 2%	4
A3R6				Same as A3R1	
A3R7	476523	BA6	K&F	RES, WW, 75K, 1/4W, .1%	1
A3R8	476570	RCL 7010		RES, WW, 50K, 1/4W, .1%	1
A3R9	471460	RL07S153G		RES, MF, 15K, 1/4W, 2%	2
A3R10				Same as A3R1	

PARTS LIST - MULTIBAND CONTROLLER (CONT)

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
A3R11	476522	BA6	K&F	RES, WW, 37.5K, 1/4W, .1%	2
A3R12				Same as A3R1	
A3R13	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	3
A3R14				RES (Select at test)	1
A3R15	471464	RL07S223G		RES, MF, 22K, 1/4W, 2%	1
A3R16	476977	BA6	K&F	RES, WW, 1K, 1/4W, 1%	1
A3R17	471401	RL07S510G		RES, MF, 51 OHM, 1/4W, 2%	1
A3R18	471409	RL07S111G		RES, MF, 110 OHM, 1/4W, 2%	1
A3R19				Same as A3R1	
A3R20	471465	RL07S243G		RES, MF, 24K, 1/4W, 2%	1
A3R21	476521	BA6	K&F	RES, WW, 12.5K, 1/4W, .1%	1
A3R22				Same as A3R1	
A3R23	475681			RES, COMP, 1.5M, 1/4WW, 10%	1
A3R24				Same as A3R1	
A3R25, R26				Same as A3R5	
A3R27	471404	RL07S680G		RES, MF, 68 OHM, 1/4W, 2%	1
A3R28	471438	RL07S182G		RES, MF, 1.8K, 1/4W, 2%	1
A3R29				Same as A3R13	
A3R30	470705	RL07S270J		RES, MF, 27 OHM, 1/8W, 5%	1
A3R31				Same as A3R13	
A3R32				Same as A3R2	
A3R33				Same as A3R11	
A3R34				Same as A3R9	
A3R35, R36				Same as A3R1	
A3R37				Same as A3R5	
A3R38				Same as A3R1	
A3S1, S4	510077	4XF12.5STD ( )2UGR	IEE-Wes	SWITCH ASSY, PUSHBUTTON	1
A4	950438			PCB, MARKER GENERATOR	1
A4C1 thru C4	155462	DM15-100J	Arco	CAP, MICA DIP, 10 pf, 500V, 5%	4
A4C5, C6	157000	192P2229R8	Sprague	CAP, MYLAR, .0022, 80V, 10%	2
A4C7 thru C10	150009	801-000-X5F0-102K	Erie	CAP, CER DISC, .001 uf, 1000V	4
A4C11	150102	TGP10(33 C 41B6)	Sprague	CAP, CER DISC, .1 uf, 100V	1
A4CR1 thru CR10	480004	1N4446	Fairchild	DIODE	22
A4CR11, CR12	480016	1N5228	Motorola	DIODE, ZENER, 3.9V	2
A4CR13 thru CR20, CR22 thru CR25				Same as A4CR1	
A4IC1	480655	LM301AH	National	IC	3
A4IC2	480661	SN7400N	Motorola	IC	1
A4IC3, IC4				Same as A4IC1	
A4Q1	485014	2N4045	Union Car	TRANSISTOR	2
A4Q2, Q3	485040	2N5087	Motorola	TRANSISTOR	4
A4Q4				Same as A4Q1	
A4Q5, Q6				Same as A4Q2	
A4Q7, Q8	485006	2N3391	GE	TRANSISTOR	2
A4R1	476565			RES, WW, 25K, 1/4W, .1%	4
A4R2, R3	471464	RL07S223G		RES, MF, 22K, 1/4W, 2%	4
A4R4	471422	RL07S391G		RES, MF, 390 OHM, 1/4W, 2%	2
A4R5				Same as A4R1	
A4R6, R7				Same as A4R2	
A4R8				Same as A4R4	
A4R9				Sames as A4R1	

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
A4R10	471480	RL07S104G		RES, MF, 100K, 1/4W, 2%	3
A4R11	471461	RL07S163G		RES, MF, 16K, 1/4W, 2%	2
A4R12	471448	RL07S472G		RES, MF, 4.7K, 1/4W, 2%	3
A4R13				Same as A4R1	
A4R14				Same as A4R10	
A4R15				Same as A4R11	
A4R16				Same as A4R12	
A4R17 thru R20	475678			RES, COMP, 1M, 1/4W, 10%	5
A4R21	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	6
A4R22				Same as A4R12	
A4R23				Same as A4R21	
A4R24	471451	RL07S622G		RES, MF, 6.2K, 1/4W, 2%	1
A4R25	471459	RL07S133G		RES, MF, 13K, 1/4W, 2%	1
A4R26				Same as A4R21	
A4R27	471438	RL07S182G		RES, MF, 1.8K, 1/4W, 2%	1
A4R28, R29				Same as A4R21	
A4R30	471432	RL07S102G		RES, MF, 1K, 1/4W, 2%	1
A4R34				Same as A4R17	
A4R35, R36				Same as A4R21	
A4R37	471446	RL07S392G		RES, MF, 3.9K, 1/4W, 2%	1
A4R38				Same as A4R10	
A4R39				Same as A4R21	
A4R40, R41	471443	RL07S302G		RES, MF, 3K, 1/4W, 2%	2
A4R42, R43	470700	RL07S100G		RES, MF, 10 OHM, 1/8W, 5%	2
A4S1 thru S4	510076	4XF12.5STD( )2UGR	IEE-Wes	SWITCH ASSY, PUSHBUTTON	1
A5	950439			PCB, AM	1
A5C1	155550	CM06FD	Arco	CAP, MICA, 2200 pf, 500V	1
A5C2	150100	TGS10	Sprague	CAP, CER DISC, .01 uf, 100V	4
A5C3	157000	192P2229R8	Sprague	CAP, MYLAR, .0022, 80V, 10%	1
A5C4	155470	DM15-270J	Arco	CAP, MICA DIP, 27 pf, 500V, 5%	2
A5C5				Same as A5C2	
A5C6				Same as A5C4	
A5C7, C8				Same as A5C2	
A5CR1, CR2, CR3	480004	1N4446	Fairchild	DIODE	3
A5CR4	480062	1N5240	Motorola	DIODE	1
A5IC1, IC2	480655	LM301AH	National	IC	2
A5IC3	480666	SP306	Signetics	IC, AND GATE	2
A5IC4	480667	SP374	Signetics	IC, OR GATE	1
A5IC5	480663	SN7472N	Motorola	IC, FLIP FLOP	1
A5IC6				Same as A5IC3	
A5K1	450004	OF IC-12	Babcock	RELAY, REED	1
A5Q1 thru Q4	485006	2N3391	GE	TRANSISTOR	4
A5Q5	480762	U13T1	Unitrode	UNIJUNCTION	1
A5R1	471448	RL07S472G		RES, MF, 4.7K, 1/4W, 2%	4
A5R2	471416	RL07S221G		RES, MF, 220 OHM, 1/4W, 2%	1
A5R3	471432	RL07S102G		RES, MF, 1K, 1/4W, 2%	2
A5R4	471442	RL07S272G		RES, MF, 2.7K, 1/4W, 2%	1
A5R5	471415	RL07S201G		RES, MF, 200 OHM, 1/4W, 2%	1
A5R6	471441	RL07S242G		RES, MF, 2.4K, 1/4W, 2%	1
A5R7	471460	RL07S153G		RES, MF, 15K, 1/4W, 2%	1
A5R8	475655	RC07GF274K		RES, COMP, 270K, 1/4W, 10%	1
A5R9	471432	RL07S102G		RES, MF, 1K, 1/4W, 2%	2

PARTS LIST - MULTIBAND CONTROLLER (CONT)

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
A5R10	471436	RL07S152G		RES, MF, 1.5K, 1/4W, 2%	1
A5R11	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	5
A5R12, R13				Same as A5R1	
A5R14	471472	RL07S433G		RES, MF, 47K, 1/4W, 2%	2
A5R15				RES (Select at test)	1
A5R16	475601	RC07GF100K		RES, COMP, 10 OHM, 1/4W, 10%	1
A5R17				RES (Select at test)	1
A5R18, R19				Same as A5R11	
A5R20				RES (Select at test)	1
A5R21	471477	RL07S753G		RES, MF, 75K, 1/4W, 2%	2
A5R22				Same as A5R14	
A5R23				Same as A5R21	
A5R24				Same as A5R1	
A5R25	471480	RL07S104G		RES, MF, 100K, 1/4W, 2%	2
A5R26				Same as A5R11	
A5R27				Same as A5R25	
A5R28	471484	RL07S154G		RES, MF, 150K, 1/4W, 2%	1
A5R29				Same as A5R11	
A5S1 thru S5	510078	5XF12.5STD		SWITCH ASSY, PUSHBUTTON	1
	510051			BUTTON, PUSHBUTTON SWITCH	5
	950444			MAIN FRAME ASSY	1
				Includes:	
C1	152455	36D922G015AB2A	Sprague	CAP, ELECTROLYTIC, 9200 uf, 15V	1
C2	152760	FAH-EX15037(698V)	Cornell Dublier	CAP, ELECTROLYTIC, 240 uf, 300V	1
C3, C4	152436	EMF S 3550		CAP, ELECTROLYTIC, 3500 uf, 50V	2
C5	150100	TGS10	Sprague	CAP, CER, .01 uf, 100V	1
DS1	510050	671-A1H	Marco	SWITCH, AC	1
DS2	390005	MU5022	Montsano	PILOT LIGHT	1
J1 thru J4	210193	1-583407-8	AMP	CONNECTOR, PC, 36-PIN DUAL CONTACTS	4
J17	210216	3 VH32/1JN5	Viking	CONNECTOR, PC, 30-PIN DUAL CONTACTS	1
R1	475550	RC07GF563		RES, FIXED COMP, 56K, 1/8W	1
R2, R6, R12	479520	WA1G040P103UA	A-B	POT, 10K (SWP Vernier)	3
R13 thru R20	471432	RL07S102G		RES, MF, 1K, 1/4W, 2%	8
R21	471412	RL07S151G		RES, MF, 150 OHM, 1/4W, 2%	1
S2, S3, S4	510075	3XF10STD( )2UGR	IEE-Wes	SWITCH ASSY, PUSHBUTTON	1
S6	510043	8655	Smith	SWITCH, MIN. SLIDE	2
T1	560012	4-2741-3	Tranex	TRANSFORMER	1
	210211	530330-1	AMP	POLARIZING KEY, PC CONNECTOR (J1 - J4)	8
	210205	50-PK-3	Cinch	POLARIZING KEY, 30-PIN DUAL CONTACT (J17)	2
	948004-26			KNOB/SKIRT ASSY, 0-10	1
	948022-1			KNOB ASSY, RED	1
	948022-2			KNOB ASSY, YELLOW	1
	948022-3			KNOB ASSY, BLUE	1
	948022-4			KNOB ASSY, GREEN	1
	962071			KNOB, 5/8 DIA BLK W/WHT STRIPE	2

PARTS LIST - MULTIBAND CONTROLLER (CONT)

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
	950445			REAR PANEL ASSY	1
				Includes:	
A7	936186			TERMINAL BOARD, AC	1
F1	510001	313001	Littlefuse	FUSE, SB, 1A	1
J5 thru J12	210011			JACK, BNC BULKHEAD	8
J13	600020	EAC-301	Switchcraft	SOCKET, LINE	1
J14, J15, J16	219002	3017	Waber	AC OUTLET, BLK SNAPIN-15A, 125V	3
J18, J19, J20	210026	221-102	Smith	JACK, RED TIP	3
R3	471432	RL07S102G		RES, MF, 1K, 1/4W, 2%	1
R9, R10, R11	479521	WA1G0125103UA	AB	POT, SCREW DR. ADJ, 10K	3
S1	510040	46256 LFR	Switchcraft	SWITCH, SLIDE, DPDT, LOCKING	1
XF1	510010	342004A	Littlefuse	FUSE HOLDER	1
	950446			DIAL ASSY	1
				Includes:	
R22, R23	471470	RL07S393G		RES, MF, 39K, 1/4W, 2%	2
R24, R25	471465	RL07S243G		RES, MF, 24K, 1/4W, 2%	2
	479662	3T7369-10-0	Beckman	POTENTIOMETER, 2K, 3-TURN	4
	510074	X5P3509	CTS	ROTARY SWITCH	1
	600001	75A-1000	G.C.	DIAL CORD	AR

PARTS LIST - COMPUTER INTERFACE PLUG-IN

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
A1	946328			PCB, PLUG-IN	
A1C1, C2	155470	DM15-270J	Arco	CAP, MICA, 27 pf, 500V, 5%	2
A1C3	157005	192P1049R8	Sprague	CAP, MYLAR, 01 uf, 80V, 10%	1
A1CR1	480004	1N4446	Fairchild	DIODE	1
A1K1	450004	OF IC-12	Babcock	RELAY, REED Form "C" 12V Coil	1
A1Q1	485006	2N3391	GE	TRANSISTOR	1
A1R1	471481	RL07S114G		RES, MF, 110K, 1/4W, 2%	1
A1R2, R3	471480	RL07S104G		RES, MF, 100K, 1/4W, 2%	2
A1R4	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	1
A1R5	475739	ZV2031	A-B	POT, 20K, 1/2 W, 10%	1
A1R6	475713	ZV5001	A-B	POT, 50 OHM, 10%, 1/2W	1
A1R7, R8	476565	BA6	K&F	RES, WW, 25K, 1/4W, 0.1%	2
A1R9	471458	RL07S123G		RES, MF, 12K, 1/4W, 2%	1
A1R10	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	1
A1R11	471448	RL07S472G		RES, MF, 4.7K, 1/4W, 2%	1
A1R12	479521	WA1G012S103UA	A-B	RES, POT, 10K, ±10%, W/Hardware	1
A1U1	480660	SN7402N	TI	IC	1
A1U2, U3	480655	LM301AH	National	IC	2
A1U4	480686	V12D4B	Datel	IC, DAC	1
A2	946323			PCB, WIRE-IN, SLOPE AMP.	1
A2C1	155470	DM15-270J	Arco	CAP, MICA, 27 pf	1
A2C2, C3, C4	150102	TGP10(33C41B6)	Sprague	CAP, CER, .1 uf	3
A2CR1	480074	1N277		DIODE	1
A2R1 thru R7	471448	RL07S472G		RES, MF, 4.7K, 1/4W, 2%	8
A2R8	471466	RL07S273G		RES, MF, 27K, 1/4W, 2%	1
A2R9	471465	RL07S243G	IR C	RES, MF, 24K, 1/4W, 2%	1
A2R10	471462	RL07S183G	P/N	RES, MF, 18K, 1/4W, 2%	1
A2R11	471443	RL07S302G		RES, MF, 3K, 1/4W, 2%	1
A2R12	471460	RL07S1502G		RES, MF, 15K, 1/4W, 2%	1
A2R13	471454	RL07S822G		RES, MF, 8.2K, 1/4W, 2%	1
A2R14		201R1033	CTS	RES, VAR, 10K	9
A2R15	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	8
A2R16				Same as A2R1	
A2R17	471480	RL07S104G		RES, MF, 100K, 1/4W, 2%	1
A2R18				Same as A2R15	
A2R19	471449	RL07S512G		RES, MF, 5.1K, 1/4W, 2%	2
A2R20, R21				Same as A2R15	
A2R22				Same as A2R19	
A2R23				Same as A2R15	
A2R24				Same as A2R14	
A2R25	475655	RC07GF2703J		RES, CC, 270K, 1/4W, 5%	2
A2R26, R27	471473	RL07S513G		RES, MF, 51K, 1/4W, 2%	6
A2R28, R29				Same as A2R14	
A2R30				Same as A2R26	
A2R31	471479	RL07S913G		RES, MF, 91K, 1/4W, 2%	2
A2R32				Same as A2R26	
A2R33, R34				Same as A2R14	
A2R35	475673			Res, CC, 1M, 1/4W, 10%	1
A2R36				Same as A2R25	
A2R37				Same as A2R26	
A2R38, R39				Same as A2R14	
A2R40	475675	RC07GF564K		RES, CC, 560K, 1/4W, 10%	1
A2R41				Same as A2R31	
A2R42				Same as A2R15	
A2R43				Same as A2R14	
A2R44, R45				Same as A2R15	
A2R46				Same as A2R26	
A2U1, U2	480677	SN7420N	TI	IC	2
A2U3		HA2405		IC	1
A2U4	480690	LM324N	National	IC	1

PARTS LIST - RF SIGNAL SOURCE

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
A1	946321			PC, WIRE IN RF SW CONN	1
A2	946324			PCB, AM	1
A2C1	154003	196D226X0025PE3	Sprague	CAP, TANT, 22 uf, 25V	2
A2C2	150100	TGS10	Sprague	CAP, CER, 0.01 uf, 100V	7
A2C3, C4	155470	DM15-270J	Arco	CAP, MICA, 27 pf, 500V	2
A2C5, C6, C7, C8	155490	DM15-101J	Arco	CAP, MICA, 100 pf, 500V	4
A2C9, C10				Same as A2C2	
A2C11	155478	DM15-560J	Arco	CAP, MICA, 56 pf	1
A2C12				Same as A2C1	
A2C13, C14 C15, C16				Same as A2C2	
A2CR1 thru CR16	48004	1N4446	Fairchild	DIODE	16
A2Q1	485029	2N4314	RCA	TRANSISTOR	5
A2Q2	485006	2N3391	GE	TRANSISTOR	5
A2Q3	485059	2N5190	Motorola	TRANSISTOR	1
A2Q4, Q5, Q6, Q7	485040	2N5087	Motorola	TRANSISTOR	4
A2Q8				Same as A2Q1	
A2Q9				Same as A2Q2	
A2Q10				Same as A2Q1	
A2Q11				Same as A2Q2	
A2Q12				Same as A2Q1	
A2Q13				Same as A2Q2	
A2Q14				Same as A2Q1	
A2Q15				Same as A2Q2	
A2Q16	485068	2N3382	Siliconix	TRANSISTOR	1
A2R1	471470	RL07S393G		RES, MF, 39K, 1/4W, 2%	1
A2R2	471466	RL07S273G		RES, MF, 27K, 1/4W, 2%	1
A2R3	471432	RL07S102G		RES, MF, 1K, 1/4W, 2%	8
A2R4	471460	RL07S153G		RES, MF, 15K, 1/4W, 2%	5
A2R5	471448	RL07S472G		RES, MF, 4.7K, 1/4W, 2%	7
A2R6	471439	RL07S202G		RES, MF, 2K, 1/4W, 2%	9
A2R7	471424	RL07S471G		RES, MF, 470 OHM, 1/4W, 2%	1
A2R8				Same as A2R5	
A2R9, R10, R11, R12	471482	RL07S124G		RES, MF, 120K, 1/4W, 2%	4
A2R13	471465	RL07S243G		RES, 24K	1
A2R14				Same as A2R3	
A2R15				Same as A2R4	
A2R16, R17				Same as A2R3	
A2R18				Same as A2R4	
A2R19	479515	ZV1031	A-B	POT, 10K, TOP ADJ	1
A2R20				RES (Select at test)	1
A2R21				RES (Select at test)	1
A2R22	475105	RC07GF512J		RES, COMP, 5.1K, 1/4W, 5%	1
A2R23	471422	RL07S391G		RES, MF, 390 OHM, 1/4W, 2%	1
A2R24	471479	RL07S913G		RES, MF, 91K, 1/4W, 2%	1
A2R25	475685			RES, COMP, 2.7M, 1/4W, 10%	1
A2R26, R27				Same as A2R5	
A2R28, R29				Same as A2R6	
A2R30				Same as A2R5	
A2R31, R32				Same as A2R6	
A2R33				Same as A2R5	
A2R34, R35				Same as A2R6	
A2R36				Same as A2R5	
A2R37, R38				Same as A2R6	
A2R39	477034	3X270	Ward Leonard	RES, WW, 2700 OHM, 3W	1
A2R40	477041			RES, WW, 390 OHM, 3W	4

PARTS LIST - RF SIGNAL SOURCE (CONT)

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
A2R41	471468	RL07S333G		RES, MF, 33K, 1/4W, 2%	5
A2R42	471408	RL07S101G		RES, MF, 100 OHM, 1/4W, 2%	4
A2R43	471444	RL07S332G		RES, MF, 3.3K, 1/4W, 2%	4
A2R44				Same as A2R3	
A2R45				Same as A2R41	
A2R46				Same as A2R40	
A2R47				Same as A2R42	
A2R48				Same as A2R43	
A2R49				Same as A2R3	
A2R50				Same as A2R40	
A2R51				Same as A2R41	
A2R52				Same as A2R43	
A2R53				Same as A2R42	
A2R54				Same as A2R3	
A2R55				Same as A2R40	
A2R56				Same as A2R41	
A2R57				Same as A2R42	
A2R58				Same as A2R43	
A2R59	477030	3X100	Ward Leonard	RES, WW, 100 OHM, 3W	1
A2R60				Same as A2R3	
A2R61, R62	471480	RL07S104G		RES, MF, 100K, 1/4W, 2%	2
A2R63				Same as A2R4	
A2R64	471457	RL07S113G		RES, MF, 11K, 1/4W, 2%	1
A2R65	471440	RL07S222G		RES, MF, 2.2K, 1/4W, 2%	1
A2R66				Same as A2R4	
A2U1	480668	SN7412IN	TI	IC	1
A2U2, U3	480655	LM301AH	National	IC	2
A2U4	480674	LM318H	National	IC	1
A2U5	480670	SN7404		IC	1
A2VR1, VR2	480016	1N5228	Motorola	DIODE, ZENER, 3.9V	2
A2VR3	480053	1N5231	Motorola	DIODE, ZENER, 5.1V	1
	480750	TXBF-032-025B	IERC	HEAT SINK, XSTR	4
A3	946326			PCB, LEVELING CONTROL	1
A3C1	150526	10 TCC-V22	Sprague	CAP, CER, 2.2 pf	1
A3C2, C3	150100	TGS10	Sprague	CAP, CER, 0.01 uf	2
A3J1	105971			CONNECTOR, RTNGLR BODY	1
A3J2	210157	KC 79-67	King	CONNECTOR, RF, BNC	1
A3R1	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	3
A3R2	471424	RL07S471G		RES, MF, 470 OHM, 1/4W, 2%	1
A3R3	471480	RL07S104G		RES, MF, 100K, 1/4W, 2%	3
A3R4	105022			POTENTIOMETER, 10K, TRIM	1
A3R5, R6				Same as A3R1	
A3R7, R8				Same as A3R3	
A3S1	105967			SWITCH, SLIDE	1
A3S2	105970			SWITCH, PB, 3 SECTION	1
A3U1	480674	LM318H	National	IC	

PARTS LIST - RF SIGNAL SOURCE (CONT)

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
	950397			HEATSINK ASSEMBLY	1
				Consisting of:	
Q1	485060	2N5302	Motorola	TRANSISTOR	3
Q2	485065	MJE340	Motorola	TRANSISTOR (with mounting kit)	3
Q3				Same as Q1	
Q4				Same as Q2	
Q5				Same as Q1	
Q6				Same as Q2	
	480755	MK-15	Motorola	MOUNTING KIT, TRANSISTOR	3
	950394			PCB, PASS TRANSISTOR	1
				Consisting of:	
A4C1, C2	152410	TE 1307	Sprague	CAP, ELECTROLYTIC, 50 uf, 50V	2
A4C3, C4, C5	154002	CSR13F226KL	Kemet	CAP, TANT, 22 uf, 35V	3
A4CR1	480003	1N4005	Dickson	DIODE	7
A4CR2 thru CR9	480073	1N4998	Motorola	DIODE	8
A4CR10 thru CR15				Same as CR1	
A4Q1 thru Q4	485006	2N3391	GE	TRANSISTOR	4
A4R1	475880	RC07GF104K		RES, FIXED COMP, 100K, 1W, 10%	1
A4R2, R3	475840	RC07GF682K		RES, FIXED COMP, 6.8K, 1W, 10%	2
A4R4	471408	RL07S101G		RES, MF, 100 OHM, 1/4W, 2%	3
A4R5	471432	RL07S102G		RES, MF, 1K, 1/4W, 2%	1
A4R6				Same as R4	
A4R7				Same as R5	
A4R8				Same as R4	
A4R9				Same as R5	
A4R10	477020	WA-3	K&F	RES, WW, 0.1 OHM, 2.5W, 3%	3
A4R11	471428	RL07S681G		RES, MF, 680 OHM, 1/4W, 2%	1
A4R12				Same as R10	
A4R13	471420	RL07S331G		RES, MF, 330 OHM, 1/4W, 2%	1
A4R14	471466	RL07S273G		RES, MF, 27K, 1/4W, 2%	1
A4R15	471462	RL07S183G		RES, MF, 18K, 1/4W, 2%	1
A4R16				Same as R10	
A4R17, R18	470708	RL07S470J		RES, MF, 47 OHM, 1/8W, 5%	2

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
A5	950395			PCB, POWER SUPPLY REGULATOR	1
A5C1	152410	TE 1307	Sprague	CAP, ELECTROLYTIC, 50 uf, 50V	3
A5C2	150100	TGS10	Sprague	CAP, ELECTROLYTIC, 0.01 uf, 100V	4
A5C3	155470	DM15-270J	Arco	CAP, MICA, 27 pf, 500V	3
A5C4, C5	157005	192P1049R8	Sprague	CAP, MYLAR, .1 uf, 80V	6
A5C6				Same as A1C1	
A5C7	154002	CSR13F226KL	Kemet	CAP, TANT, 22 uf, 35V	2
A5C8				Same as A1C2	
A5C9				Same as A1C3	
A5C10, C11				Same as A1C4	
A5C12				Same as A1C2	
A5C13				Same as A1C3	
A5C14				Same as A1C2	
A5C15, C16				Same as A1C4	
A5C17				Same as A1C7	
A5C18				Same as A1C1	
A5CR1	480071	1N5247	Motorola	DIODE, ZENER, 17V	1
A5CR2	480004	1N4446	Fairchild	DIODE	1
A5CR3	480037	STB567	GE	DIODE	3
A5CR4	480019	1N5235A	Motorola	DIODE, 6.8V	1
A5CR5	480011	1N827	IRC	DIODE, ZENER, 6.2V	1
A5CR6	480070	1N5246	Motorola	DIODE, ZENER, 16V	2
A5CR7				Same as A1CR3	
A5CR8				Same as A1CR6	
A5CR9				Same as A1CR3	
A5IC4, IC5, IC6	480655	LM301AH	National	IC	3
A5Q1, Q2	485004	2N2102	RCA	TRANSISTOR	2
A5Q3	485029	2N4314	RCA	TRANSISTOR	1
A5R2	476971	RCL 7010		RES, WW, 1.73K, 1/4W, 1%	1
A5R3	471480	RL07S104G		RES, MF, 100K, 1/4W, 2%	3
A5R4	479562	U-201R103B	CTS	RES, VAR, 10K	3
A5R5	476981			RES, WW, 3.9K, 1/4W, 1%	1
A5R7	471433	RL07S112G		RES, MF, 1.1K, 1/4W, 2%	1
A5R8	471438	RL07S182G		RES, MF, 1.8K, 1/4W, 2%	1
A5R9	471442	RL07S272G		RES, MF, 2.7K, 1/4W, 2%	2
A5R10	470673	RL07S5R0G		RES, MF, 5 OHM, 1/4W, 2%	2
A5R11	471446	RL07S392G		RES, MF, 3.9K, 1/4W, 2%	1
A5R12	471453	RL07S752G		RES, MF, 7.5K, 1/4W, 2%	1
A5R14	476983	RCL 7010		RES, WW, 5K, 1/4W, 1%	3
A5R15				Same as A1R3	
A5R16	476984	RCL 7010		RES, WW, 10K, 1/4W, 1%	1
A5R17				Same as A1R4	
A5R18	471444	RL07S332G		RES, MF, 3.3K, 1/4W, 2%	1
A5R19	471441	RL07S242G		RES, MF, 2.4K, 1/4W, 2%	1
A5R20				Same as A1R14	
A5R21				Same as A1R3	
A5R22				Same as A1R14	
A5R23				Same as A1R4	
A5R24				Same as A1R10	
A5R25				Same as A1R9	

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
	950718			RF MODULE, .5 - 1.0 GHZ	
				Consisting of:	
	950484			PCB, LINEARIZER	1
				Consisting of:	
C1 thru C4, C8, C9	150100	TGS10	Sprague	CAP, CER DISC, 0.01, 100V	6
C5, C6	155470	DM15-270J	Arco	CAP, MICA, 27 pf	2
C7	155511	DM15-331J	Arco	CAP, MICA, 330 pf	1
C10	157020	192P2249R8	Sprague	CAP, MYLAR, 0.22, 80V	1
C11	155500	DM-15-151J	Arco	CAP, MICA, 150 pf	1
C12	155462	DM15-100J	Arco	CAP, MICA, 10 pf	1
C13	155490	DM15101J	Arco	CAP, MICA, 100 pf	1
CR1 thru CR17	480004	1N4446	Fairchild	DIODE	22
CR18, CR19	480041	1N5232	Motorola	DIODE	2
CR20 thru CR24				Same as CR1	
CR25	480018	1N5266	Motorola	DIODE	1
IC1, IC2, IC3	480655	LM301AH	National	IC	3
Q1, Q3	485029	2N4314	RCA	TRANSISTOR	2
Q2, Q4	485007	2N3440	RCA	TRANSISTOR	2
R1 thru R32				RES (Select at test)	32
R33	471473	RL07S513G		RES, MF, 51K, 1/4W, 2%	5
R34	471480	RL07S104G		RES, MF, 100K, 1/4W, 2%	2
R35, R36, R37				Same as R33	
R38, R39	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	7
R40 thru R42				RES (Select at test)	3
R43	471439	RL07S202G		RES, MF, 2K, 1/4W, 2%	2
R44 thru R47				RES (Select at test)	4
R48	475678			RES, FIXED COMP, 1M, 1/4W, 10%	2
R49				Same as R38	
R50	471449	RL07S512G		RES, MF, 5.1K, 1/4W, 2%	1
R51	471456			Same as R38	
R52, R53	475939	RC07GF183K		RES, FIXED COMP, 18K, 2W, 10%	2
R54				RES (Select at test)	
R55				Same as R33	
R56	471430	RL07S821G		RES, MF, 820 OHM, 1/4W, 2%	1
R57	472210	RL07S511G		RES, MF, 510 OHM, 1/2W, 2%	1
R58				Same as R34	
R60				Same as R48	
R61				Same as R38	
R62				Same as R43	
R63	471442	RL07S272G		RES, MF, 2.7K, 1/4W, 2%	1
R64	471464	RL07S223G		RES, MF, 22K, 1/4W, 2%	1
R65, R66				Same as R38	
R69	471476	RL07S683G		RES, MF, 68K, 1/4W, 2%	1
	946325			PCB, POWER CONTROL	1

PARTS LIST - RF SIGNAL SOURCE (CONT)

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
	950719			RF MODULE, 1-4 GHZ	1
				Consisting of:	
C1	152410	TE 1307	Sprague	CAP, 50 uf, 50V	1
R1	477163	RH-5 package	Dale	RES, 10 OHM, 5W, 1%	1
VR1, VR2	480053	1N5231		DIODE, ZENER, 5.1V	2
	110119			OSCILLATOR, 1-4 GHZ	1
	946305-1			PCB, YIG DRIVER	1
				Consisting of:	
C1	157010	192P10292	Sprague	CAP, MYLAR, .001 uf, 200V	2
C2	155462	DM15-100J	Arco	CAP, 10 pf, 500V, 5%	2
C4				Same as C1	
C5	155509	DM15-271J	Arco	CAP, MICA, 270 pf, 500V	1
C6	155470	DM15-270J	Arco	CAP, MICA, 27 pf, 500V	3
C7	150010	TG-D-50	Sprague	CAP, CER, .005 uf, 100V	1
C8	150920	8133-000-W5R0-104K	Erie	CAP, CER, .1 uf, 100V	5
C9	154003	196D226X0025PE3	Sprague	CAP, TANT, 22 uf, 25V	1
C10				Same as C1	
C11				Same as C6	
C12				Same as C8	
C13	150100	TGS10	Sprague	CAP, CER, .01 uf, 100V	1
C14	155511	DM15-331J	Arco	CAP, MICA, 330 pf, 500V	1
C15				Same as C8	
C16	155463	DM15-150J	Elmenco	CAP, 15 pf, 500V, 5%	1
C17				Same as C6	
C18, C19				Same as C8	
CR1, CR3, CR4, CR6	480004	1N4446	Fairchild	DIODE	5
CR7	485015	ID200	Unitrode	SCR	1
CR8				Same as CR1	
K1	450012	10A1N-AA24	Babcock	RELAY, FORM A 24V, 10A	1
Q1	485006	2N3391	GE	TRANSISTOR	2
Q2	485059	2N5190	Motorola	TRANSISTOR	2
Q3	485004	2N2102	RCA	TRANSISTOR	1
Q4				Same as Q1	
Q5				Same as Q2	
R1	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	4
R2	471452	RL07S682G		RES, MF, 6.8K, 1/4W, 2%	1
R3	471484	RL07S154G		RES, MF, 150K, 1/4W, 2%	2
R4, R5, R6	471473	RL07S513G		RES, MF, 51K, 1/4W, 2%	4
R7	471448	RL07S472G		RES, MF, 4.7K, 1/4W, 2%	2
R8	471482	RL07S124G		RES, MF, 120K, 1/4W, 2%	1
R9	475661	RC07GF474K		RES, 470K, 1/4W, 10%	1
R10				Same as R4	
R12	479518	ZH 1031	A-B	POT, 10K, 10%, CERMET	1
R13	471463	RL07		RES, MF, 20K, 1/4W, 2%	1
R14	479517	ZH5021	A-B	POT, 5K, 10%	1
R16	471464	RL07S223G		RES, MF, 22K, 1/4W, 2%	1
R17	475601	RC07GF100K		RES, COMP, 10 OHM, 1/4W, 10%	2
R18	471408	RL07S101G		RES, MF, 100 OHM, 1/4W, 2%	2
R19				Same as R1	
R20	471478	RL07S823G		RES, MF, 82K, 1/4W, 2%	1
R21				Same as R3	

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
R22, R23	471449	RL07S512G		RES, MF, 5.1K, 1/4W, 2%	2
R24	471424	RL07S471G		RES, MF, 470 OHM, 1/4W, 2%	1
R25	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	4
R26	479508	ZH1021	A-B	POT, 1K, 10%	1
R28	471454	RL07S822G		RES, MF, 8.2K, 1/4W, 2%	2
R29	471438	RL07S182G		RES, MF, 1.8K, 1/4W, 2%	1
R30				Same as R1	
R32	471462	RL07S183G		RES, MF, 18K, 1/4W, 2%	1
R33				Same as R28	
R34				Same as R18	
R35	471416	RL07S221G		RES, MF, 220 OHM, 1/4W, 2%	1
R36				Same as R7	
R37				Same as R17	
R38	471469	RL07S363G		RES, MF, 36K, 1/4W, 2%	1
R39	471401	RL07S510G		RES, MF, 51 OHM, 1/4W, 2%	1
R40	471472	RL07S473G		RES, MF, 47K, 1/4W, 2%	1
U1, U2, U3	480655	LM301AH	National	IC	4
U4	480674	LM318H	National	IC	1
U5				Same as U1	
VR1	480076	1N5259	Motorola	DIODE, ZENER, 3.9V	1
VR2	480011	1N827	IRC	DIODE, ZENER, 6.2V	1
VR3	485015	ID200	Unitrode	SCR	1

PARTS LIST - RF SIGNAL SOURCE (CONT)

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
	950720			RF MODULE, 4-8 GHZ	1
				Consisting of:	
C1	152410	TE1307	Sprague	CAP, 50 uf, 50V	1
R1	477163	RH-5	Dale	RES, 10 OHM, 5W, 1%	1
R2	477036	3X300	Ward Leonard	RES, WW, 300 OHM, 3W, 10%	1
VR1, VR2, VR3	480045	1N5231	Dickson	DIODE, ZENER, 5.1V	3
	110107	AV-7401M-1	Avantek	OSCILLATOR, 4-8 GHZ	1
	110004			CIRCULATOR	1
	946274-1			PCB, YIG DRIVER	1
				Consisting of:	
C1	157010	192P10292	Sprague	CAP, MYLAR, .001 uf, 200V	2
C2	155470	DM15-270J	Arco	CAP, MICA, 27 pf, 500V	3
C3	150100	TGS10	Sprague	CAP, CER, .01 uf, 100V	1
C4	150920	8133-000-W540-104K	Erie	CAP, CER, .1 uf, 100V	5
C5				Same as C2	
C7	155509	DM15-271J	Arco	CAP, MICA, 270 pf, 500V	1
C8				Same as C1	
C9				Same as C2	
C10	155511	DM15-331J	Arco	CAP, MICA, 330 pf, 500V	1
C11				Same as C4	
C12	150010	TG-D-50	Sprague	CAP, CER, .005 uf, 100V	1
C13				Same as C4	
C14	154003	196D226X0025PE3	Sprague	CAP, TANT, 22 uf, 25V	1
C15, C16	155462	DM15-100J	Arco	CAP, MICA, 10 pf, 500V	3
C17, C18				Same as C4	
C19				Same as C15	
CR1	480011	1N827	IRC	DIODE, ZENER, 6.2V	1
CR2	480004	1N4446	Fairchild	DIODE	4
CR3					
CR4	485015	1D200	Unitrode	SCR	1
CR5	480071	1N5247	Motorola	DIODE, ZENER, 17V	1
CR6	480003	1N4005	Dickson	DIODE, RECTIFIER	1
CR7, CR9				Same as CR2	
CR10	480076	1N5259	Motorola	DIODE, ZENER, 39V	1
IC1 thru IC4	480655	LM301AH	National	IC	4
IC5	480674	LM318H	National	IC	1
K1	450012	10A1N-AA24	Babcock	RELAY, FORM A, 24V, 10A, 1N-AA24	1
Q1	485004	2N2102	RCA	TRANSISTOR	2
Q2	485059	2N5190	Motorola	TRANSISTOR (with insul. & washer)	2
Q3	485006	2N3391	GE	TRANSISTOR	2
Q4				Same as Q2	
Q5				Same as Q1	
Q6				Same as Q3	
R1	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	5
R2	471470	RL07S393G		RES, MF, 39K, 1/4W, 2%	2
R4	479517	62-2-1-502	Spectrol	RES, POT, 5K, 10%	2
R5	475680			RES, COMP, 2.2M, 1/4W, 10%	1
R6	600515			JUMPER, #24 INSULATED	1
R7	471463	RL07S203G		RES, MF, 20K, 1/4W, 2%	2
R8, R9, R10				Same as R1	

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY.
R11	471438	RG1/4	TRW	RES, MF, 1.8K, 1/4W, 2%	1
R12	471414	RL07S181G		RES, MF, 180 OHM, 1/4W, 2%	1
R13	471408	RL07S101G		RES, MF, 100 OHM, 1/4W, 2%	2
R14	471473	RL07S513G		RES, MF, 51K, 1/4W, 2%	3
R15	471458	RL07S123G		RES, MF, 12K, 1/4W, 2%	1
R16, R17				Same as R14	
R18				Same as R4	
R20	471466	RL07S273G		RES, MF, 27K, 1/4W, 2%	1
R21	471479	RL07S913G		RES, MF, 91K, 1/4W, 2%	1
R22	479509	BD35385(P115R102A)	CTS	RES, POT, 1K, 10%	1
R23	471480	RL07S104G		RES, MF, 100K, 1/4W, 2%	1
R26	471416	RL07S221G		RES, MF, 220 OHM, 1/4W, 2%	1
R27	475601	RC07GF100K		RES, COMP, 10 OHM, 1/4W, 10%	2
R29	471462	RL07S183G		RES, MF, 18K, 1/4W, 2%	1
R31				Same as R7	
R32				Same as R1	
R33, R34	471448	RL07S472G		RES, MF, 4.7K, 1/4W, 2%	2
R35	471464	RL07S223G		RES, MF, 22K, 1/4W, 2%	1
R36				Same as R13	
R37	471424	RL07S471G		RES, MF, 470 OHM, 1/4W, 2%	1
R38	471454	RL07S822G		RES, MF, 8.2K, 1/4W, 2%	1
R39	471449	RL07S512G		RES, MF, 5.1K, 1/4W, 2%	1
R40				Same as R2	
R44	471452	RL07S682G		RES, MF, 6.8K, 1/4W, 2%	1
R45	471401	RN55 D51R1F		RES, MF, 51 OHM, 1/4W, 2%	1
R46				Same as R27	

PARTS LIST - RF SIGNAL SOURCE (CONT)

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
	950721			RF MODULE, 8.0-12.4 GHZ	1
				Consisting of:	
C1	152410	TE 1307	Sprague	CAP, 50 uf, 50V	1
R1	477102	RH-5	Dale	RES, 5 OHM, 5W, 1% (3% R)	1
VR1, VR2	480045	1N5231	Dickson	DIODE, ZENER, 5.1V	2
	2016			OSCILLATOR, 8.0-12.4 GHZ	1
	110009			CIRCULATOR	1
	946274-2			PCB, YIG DRIVER	1
				Consisting of:	
C1	157002	192P1039R8	Sprague	CAP, MYLAR, .01 uf, 80V	1
C2	155470	DM15-270J	Arco	CAP, MICA, 27 pf, 500V	3
C3	150100	TGS10	Sprague	CAP, CER, .01 uf, 100V	1
C4	150920	8133-000-W5R0-104K	Erie	CAP, CER, .1 uf, 100V	5
C5				Same as C2	
C7	155509	DM15-271J	Arco	CAP, MICA, 270 pf, 500V	1
C8	157022	192P33292	Sprague	CAP, MYLAR, .0033 uf, 200V	1
C9				Same as C2	
C10	155511	DM15-331J	Arco	CAP, MICA, 330 pf, 500V	1
C11				Same as C4	
C12	150010	TG-D-50	Sprague	CAP, CER, .005 uf, 100V	1
C13				Same as C4	
C14	154003	196 D 226 X 0025 PE3	Sprague	CAP, TANT, 22 uf, 25V	1
C15, C16	155460	DM15-050K	Arco	CAP, MICA, 5 pf, 500V	2
C17, C18				Same as C4	
C19	155473	DM15-390J	Arco	CAP, MICA, 39 pf, 500V	1
CR1	480011	1N827	IRC	DIODE, ZENER, 6.2V	1
CR2, CR3	480004	1N4446	Fairchild	DIODE	4
CR4	485015	1D200	Unitrode	SCR	1
CR6	480003	1N4005	Dickson	DIODE, RECTIFIER	1
CR7, CR9				Same as CR2	
CR10	480076	1N5259	Motorola	DIODE, ZENER, 39V	1
IC1 thru IC4	480655	LM301AH	National	IC	4
IC5	480674	LM318H	National	IC	1
K1	450012	10A1N-AA24	Babcock	RELAY, FORM 2A, 24V, 10A 1N-AA24	1
Q1	485004	2N2102	RCA	TRANSISTOR	2
Q2	485059	2N5190	Motorola	TRANSISTOR (with insul. & washer)	2
Q3	485006	2N3391	GE	TRANSISTOR	2
Q4				Same as Q2	
Q5				Same as Q1	
Q6				Same as Q3	
R1	471456	RL07S103G		RES, MF, 10K, 1/4W, 2%	4
R2	471475	RL07S623G		RES, MF, 62K, 1/4W, 2%	1
R4	479517	ZH5021	A-B	RES, POT, 5K, 10%	2
R5	475680			RES, COMP, 2.2M, 1/4W, 10%	1
R6	471480	RL07S104G		RES, MF, 100K, 1/4W, 2%	1
R7	471463	RL07S203G		RES, MF, 20K, 1/4W, 2%	2
R8, R9, R10				Same as R1	
R11	471438	RL07S182G		RES, MF, 1.8K, 1/4W, 2%	1
R12	471414	RL07S181G		RES, MF, 180 OHM, 1/4W, 2%	1
R13	471408	RL07S101G		RES, MF, 100 OHM, 1/4W, 2%	2

PARTS LIST - RF SIGNAL SOURCE (CONT)

REFERENCE DESIGNATION	SYSTRON DONNER PART NUMBER	MFR'S PART NUMBER	MFR	DESCRIPTION	QTY
R14	471473	RL07S513G		RES, MF, 51K, 1/4W, 2%	3
R15	471458	RL07S123G		RES, MF, 12K, 1/4W, 2%	1
R16, R17				Same as R14	
R18				Same as R4	
R20	471477	RL07S753G		RES, MF, 75K, 1/4W, 2%	1
R21	475650	RL07S184G		RES, COMP, 180K, 1/4W, 10%	1
R22	479508	ZH1021	A-B	RES, POT, 1K, 10%	1
R23	475657	RC07GF334K		RES, COMP, 330K, 1/4W, 10%	1
R26	471416	RL07S221G		RES, MF, 220 OHM, 1/4W, 2%	1
R27	475601	RC07GF100K		RES, COMP, 10 OHM, 1/4W, 10%	2
R29	471462	RL07S183G		RES, MF, 18K, 1/4W, 2%	1
R31				Same as R7	
R32	471465	RL07S243G		RES, MF, 24K, 1/4W, 2%	1
R33, R34	471448	RL07S472G		RES, MF, 4.7K, 1/4W, 2%	2
R35	471464	RL07S223G		RES, MF, 22K, 1/4W, 2%	1
R36				Same as R13	
R37	471424	RL07S471G		RES, MF, 470 OHM, 1/4W, 2%	2
R38	471454	RL07S882G		RES, MF, 8.2K, 1/4W, 2%	1
R39	471449	RL07S512G		RES, MF, 5.1K, 1/4W, 2%	1
R40	471470	RL07S393G		RES, MF, 39K, 1/4W, 2%	1
R44				Same as R37	
R45	471401	RL07S510G		RES, MF, 51 OHM, 1/4W, 2%	1
R46				Same as R27	
	950738			INTERNAL LEVELING	1

SECTION IX

DIAGRAMS

This section contains the following diagrams:

Model 521 Multiband Controller

C900304 Schematic, Interconnection
C900299 Schematic, Power Supply (A1)
C900300 Schematic, Sweep Generator (A2)
C900301 Schematic, Mode Generator (A3)
C900302 Schematic, Marker Generator (A4)
C900303 Schematic, AM Board (A5)

Model 551-1 (SP-1046) Computer Interface Plug-In

900567 Schematic - Model 551-1 SP1046 Plug-In

Model 525 RF Signal Source

900573 Schematic, 525
900566 Schematic, A.M. Control Assy (A2)
900565 Schematic, Leveling Preamp/Control (A3)
900572 Schematic Diagram, Power Supply
900569 Schematic, Varacter Tuned Osc. Module, 500-1000 MHz
C900424 Schematic Diagram, Linearizer
900570 Schematic, YIG Tuned Osc. Module 1-4 GHz
900500 Schematic Diagram, YIG Driver
900571 Schematic - YIG Tuned Osc. Module 4-18 GHz
C900407 Schematic Diagram, 572 YIG Driver

DATE	SYM	REVISION RECORD	AUTH		

LINE TRIGGER OUTPUT
BLU/BRN

SUB ASSY 950443

EXT TRIG

GRN/WHT

R3 1K

FREQ VOLT

+200V +15V -15V +5V 0V

2K, 3T
MARKER 1 FC/CW
0V

R23 39K
-15
R8 2K 3T
MARKER 2 SYM UP MARKERS
0V

0V
+5V

M2 MODIF.

ATTENUATION

S8 (UNITS)

S9 (TENS)

+5V
0V

J10 MARKER OUTPUT

R13 1K
R14 1K
R15 1K
R16 1K
R17 1K
R18 1K
R19 1K
R20 1K

ATTENUATION CONTROL OUTPUT

MARKER GEN M2 INPUT
MARKER REF OUTPUT
M2 REF OUTPUT
QUIETING DISABLE
REMOTE POWER INPUT
REMOTE POWER CONTROL
LOCAL RF OFF ENABLE
RF INHIBIT CONTROL
1 KHZ LOCAL CONTROL
BLANKING LOCAL CONTROL
EXT AM OUT
UNLEVELED LIGHT IN

+5
R21 150
DS2 UNLEVELED

INTENSITY MARKER TIME ADJ.
MARKER ADJ.
GRN
YEL/WHT
MARKER OUT
EXTERNAL FM
RETRACE CONTROL
0V -5V -15V -15V 0V
POWER

1. RESISTORS IN OHMS, ¼W, 2%, METAL FILM
   ALL RESISTORS LABLED 5% OR 10% ARE ½W, FIXED COMP.
2. SWITCHES: 1-NO, 2-NC
3. TYP. WIRE: +15 - ORN
   +5 - RED/WHT
   -15 - PUR
   0V - BLK

TOLERANCES (EXCEPT AS NOTED)			
DECIMAL ±	USED ON: 521 SERIAL NO. 26-40	SCALE —	DRAWN BY R. DEAN APPROVED BY
FRACTIONAL ±	TITLE: SCHEMATIC INTERCONNECTION		
ANGULAR ±	DATE	DRAWING NUMBER	REV

K+E ALBANENE © 10-5463 Engineers' Standard Form

DATE	SYM	REVISION RECORD	AUTH	DR	CK.
2-16-72	A	REVISED PER E.C.O. [illegible] & REF. PARTS FOR [illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9-73	[illegible]	[illegible] VICE E.C.O. 451	[illegible]	M	[illegible]
7-20-73	D	REL. PER E.C.O. IC-74 REL. PER E.C.O. 0257	[illegible]	[illegible]	[illegible]

J3

-15V

SWEEP OUTPUT (TO PLUG-IN & MODE GEN.)

+15V

MANUAL SCAN O/P (TO PLUG-IN)

R5 5.1K

R10 180

ZERO

CR4 IN4446

CR3 IN4446

C1 27 PF

IC1 LM301 AH

R11 820K 10%

R12 100K MAN'L SCAN MAX

INTENSITY MARKER DRIFT

R27 10K

R28 1K SWEEP MAX

IC2 LM301 AH

CR9 IN5228A 3.9V

R29 15K

IC4B SN7474N

1/2 IC4B

IC4A SN7474N

1/2 IC4A

1/3 IC5B SP370

IC5B SP370

1/3 IC5A

IC5A SP370

1/3 IC6A

IC6A SN7410N

IC6C SN7410N

1/3 IC6B

IC6B SN7410N

IC5C SP370

1/3

TRIGGER

J3

26 CW MODE CONTROL (FROM MODE GENERATOR)

25 BLANKING REFERENCE (TO AM CARD & MARKER GENERATOR)

C2 .01 200V MYLAR

C3 .047 100V MYLAR

C4 .1 100V MYLAR

S1 S2 S3 S4 S5

R24 1K MAN SCAN ZERO

1.1K

R23 1.85K

R2 VERNIER MAN'L SCAN

R14 2.2K

R15 4.7K

CR6 IN4446

CR7 IN4447

R17 4.7K

R16 4.7K

+5V

R19 430

R20

Q3 2N5087

R21 22K

R22 1K

Q4

391

C6 .1 15V

IC8 SN74121N MULTIVIBRATOR (500ms)

35 +5V

+5V

0V.

C7 .1, 100V CER.

IC9 SN74121N MULTIVIBRATOR (3ms)

J3

33 SWEEP STOP CONTROL (FROM MARKER GEN AND PLUG-IN)

32 PEN LIFT CONTROL (TO PEN LIFT RELAY)

1/4 IC7A

IC7A SN7400N

1/4 IC7B

IC7B SN7400N

1/4 IC7C

IC7C SN7400N

R37

A2, SWEEP GENERATOR 950436

1. UNLESS OTHERWISE SPECIFIED:
   - 1A - ALL RESISTORS IN OHMS, 1/4W, 2% METAL FILM
   - 1B - ALL RESISTORS LABLED 5% OR 10% ARE 1/4W, FIXED COMP.
   - 1C - ALL RESISTORS LABLED 1% OR .1%, 1/4W, WW ARE WIREWOUND 10PPM
   - 1D - ALL CAPACITORS IN MICROFARADS. 500V. MICA.
2. [illegible]
3. ALL SWITCHES IN POSITION 1 - N.O., AND POSITION 2 - N.C.
4. SWITCHES S1 THRU S5 ARE INTERLOCKED

ML950436	521	(REF)
NEXT ASSY	USED ON	QTY
APPLICATION		

TOLERANCES (EXCEPT AS NOTED)			
DECIMAL ± ~	SERIAL NO: 56-UP	SCALE —	DRAWN BY E APPROVED BY [illegible]
FRACTIONAL ± ~	TITLE SCHEMATIC SWEEP GENERATOR		
ANGULAR ± ~	DATE 30 AUG 71	DRAWING NUMBER [illegible]	[illegible]

K+E ALBANENE © 10 5460

REF DESIGS USED C1-C7, CR1-CR9, R1-R36, IC1-IC9, Q1-Q6

MADE IN U.S.A.

DATE	SYM	REVISION RECORD	AUTH	ED	#
2-1-	A	REVISED PER REQ'NS RELEASED FOR PROD			1

TO MARKER GENERATOR REF. INPUT

ΔF/CW VERNIER

+15 ... -15

S6 ON/OFF

J2

20

25

EXT FM (FROM AC)

R20 24K

R19 25K .1%

R24 2K 3T

F START

+5V

MARKER GEN M1 INPUT

J2

35

29

-15

R23

TO MARKER M2 INPUT

R22

R7 2K 3T

MARKER1 FC/CW

MARKER2 SYM ΔF MARKERS

R35 25K .1%

R36 25K .1%

CER 100V

.01 80V

.01 CER 100V

-5V

J2

32

-15V

-15V

36

TO QUIETING SWEEP INHIBIT

A3 MODE GENERATOR, 950437

NOTE:

1. [illegible] BE SPECIFIED:
   - [illegible] IN OHMS, ¼W, 2%, METAL FILM
   - [illegible] LABELED 5% OR 10% ARE ¼W FIXED COMP.
   - [illegible] RESISTORS LABELED 1% OR .1%, 1/4W, WW ARE WIREWOUND 10PPM
   - [illegible] AL CAPACITORS IN MICROFARADS. 500V, MICA
2. * - INDICATES VALUE SELECTED AT TEST
3. ALL SWITCHES POSITION 1 - N.O., AND POSITION 2 - N.C.
4. SWITCH S6 ON - OFF, S1 THRU S4 = INTERLOCKED

REF. DESIG USED: C1-C28; CR1; IC1-IC6; R1-R38

TOLERANCES (EXCEPT AS NOTED)			
DECIMAL ±	USED ON: 521 SERIAL NO: 16- UP	SCALE —	DRAWN BY R. DEHN; APPROVED BY
FRACTIONAL ±	TITLE SCHEMATIC MODE GENERATOR		
ANGULAR ±	DATE	DRAWING NUMBER C-0[illegible]C1	REV A

K+E ALBANENE © 10 0-665 ENGINEERS' STANDARD FORM

MADE IN U.S.A. 89700

DATE	SYM	REVISION RECORD	AUTH	OR

J1

R1 390

R2 .1% WW

C1 FF

C2 FF

C3 FF

C4 10 FF

C5 .1 MFD 27

C6 .1 MFD 27

47K

47

.001 CER 100V

.001 CER 100V

.001 CER 100V

.001 100V

IC2 R SN7400

IC2 R SN7400

R40 3K

R41 3K

R43 10

CR12 IN5228 3.9V

CR11 IN5228 3.9V

R42 10

M1

R1 75K *

10K *

1K *

10 K

CR24 IN4446

R37 3.9K

.1 CER

CR19 IN4446

R36 10K

CR20 IN4446

CR23 IN4446

CR13 IN4446

CR15 IN4446

CR14 IN4446

RETRACE BLANKING IN (FROM SWEEP GEN. BOARD)

25

TO

27

BLANKING OUTPUT

J3

INT. MARKER TIME ADJUST

R21, 10K

S1 AMPLITUDE MARKER

21

INTERLOCKED

S2 OFF

S3 INTENSITY MARKER

+5V

R22

CR25 IN4446

J2 MARKER OUTPUT

TO AM BOARD MARKER INPUT

TO MARKER REF OUTPUT (PLUG-IN SOCKET)

PUSH ON/OFF

S4 RETRACE

TO AM BOARD RETRACE CONTROL

A4 MARKER GENERATOR SUB-ASSY 0-[illegible]

UNLESS OTHERWISE SPECIFIED:

1. RESISTORS IN OHMS ¼W, 2% METAL FILM.
   CAPACITORS LABELED 5% OR 10% ARE ¼W FIXED COMP
   RESISTORS LABELED 1% OR 1%, ¼W, WW. ARE WIREWOUND 10 PPM
   CAPACITORS IN MICROFARADS, 500V, MICA
2. * - INDICATES VALUE SELECTED AT TEST
3. ALL SWITCHES POSITION 1 - N.O. AND POSITION 2 - N.C
4. SWITCHES S4 = PUSH ON-OFF; S1 THRU S3 = INTERLOCKED
5. MODEL 521, M1: a) REMOVE R30
   b) ADD CIRCUIT M1

TOLERANCES (EXCEPT AS NOTED)			
DECIMAL ±	USED ON: 521 SERIAL NO 16-UP	SCALE	DRAWN BY [illegible] APPROVED BY
FRACTIONAL ±	TITLE SCHEMATIC MARKER GENERATOR		
ANGULAR ±	DATE 18 AUG 71	DRAWING NUMBER 670030C	REV C

K&E ALBANENE @ 10 5465 ENGINEERS' STANDARD FORM

RED DESIG USED: C1-C11; CR1-CR24; IC1-IC4; Q1-Q9; R1-R43

MADE IN U.S.A.

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
2-15-72	A	REVISED PER RELEASED FOR PROD			

S7 PULL FOR UNLEVELED

POWER

REMOTE RF OFF (FROM PLUG-IN)

REMOTE POWER CONTROL (FROM PLUG-IN)

J6 EXT AM

+5V (CLEAR)

EXT FM OUT (TO PLUG-IN)

J7 EXT FM

QUITING USABLE (TO PLUG-IN)

EXT AM OUT (TO PLUG-IN)

J4

MARKER IN (FROM REAR PANEL)

LOCAL RF OFF ENABLE (FROM PLUG-IN)

RF INHIBIT CONT. (FROM PLUG-IN)

+5V

0V (DIGITAL)

1KHZ FREQ ADJ

IC5 SN7472N

IC3B SP306A

IC4 SP374A

IC6A SP306A

S1 EXT FM

S2 EXT AM

S3

1KHZ OUTPUT

1KHZ ON CONT. (FROM PLUG-IN)

1KHZ LOCAL CONT (FROM PLUG-IN)

BLANKING CONT (FROM SWEEP CARD)

RETRACE CONT (FROM MARKER CARD)

BLANKING LOCAL CONT (FROM PLUG-IN)

A5 AMPLITUDE MODULATION

1. UNLESS OTHERWISE SPECIFIED:
   1A. ALL RESISTORS IN OHMS, ¼W, 2%, METAL FILM
   1B. ALL RESISTORS LABLED 5% OR 10% ARE ¼W, FIXED COMP
   1C. ALL CAPACITORS IN MICROFARADS, MICA
2. * INDICATES VALUE SELECTED AT TEST.
3. ALL SWITCHES IN POSITION 1 NORMALLY OPEN, AND POSITION 2 IS NORMALLY CLOSE.
4. SWITCHES S1 : PUSH ON-OFF; S2 THRU S5 : INTERLOCKED

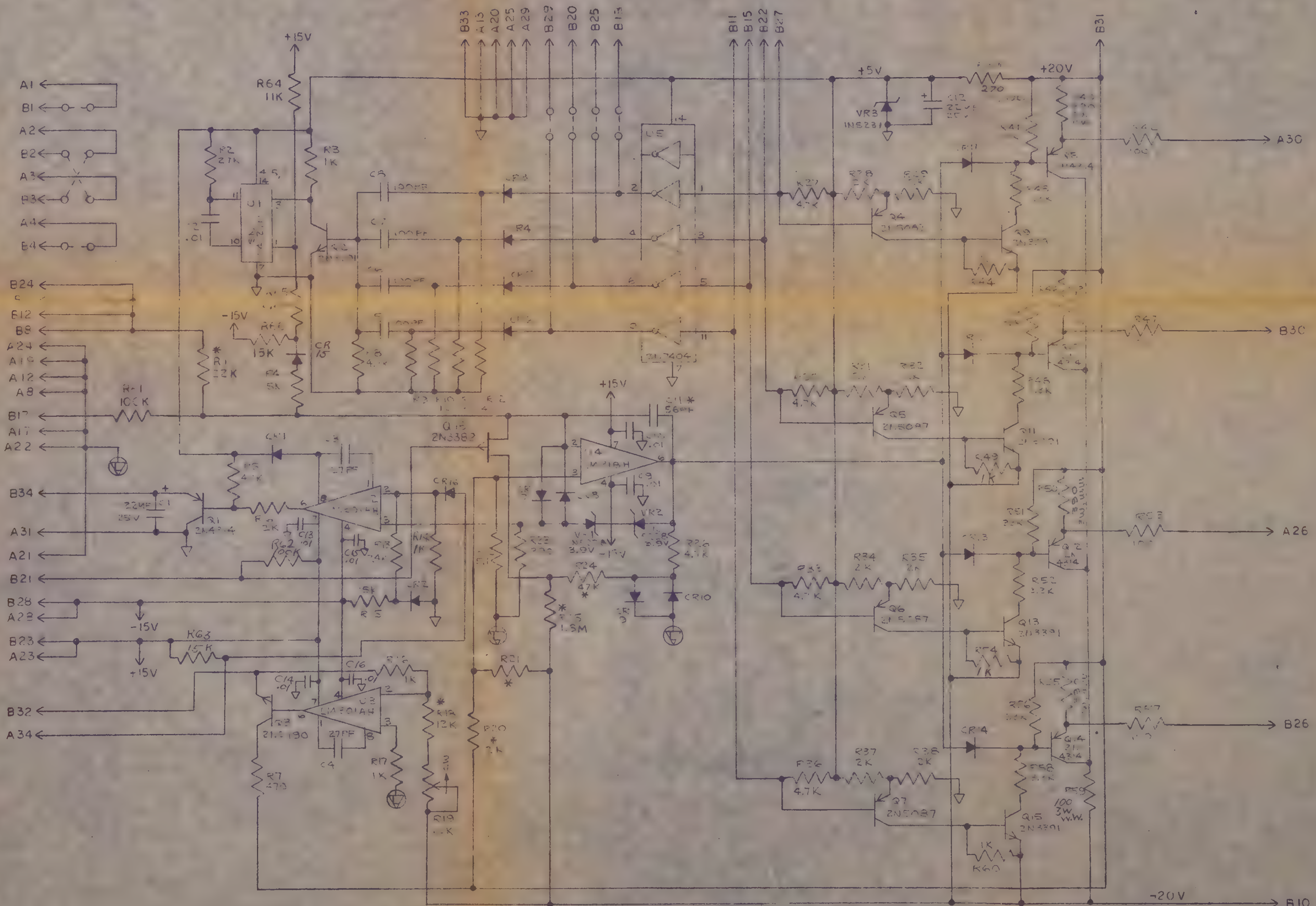
TOLERANCES (EXCEPT AS NOTED)			
DECIMAL ±	.X : .16-UP	SCALE —	DRAWN BY APPROVED BY
FRACTIONAL ±	TITLE SCHEMATIC AM BOARD		
ANGULAR ±	DATE 1 SEPT 71	DRAWING NUMBER 0900-6	REV. E

REF DESIG USED C1-C8; R1-R29; CR1-CR4; IC1-IC6, Q1-Q5

K&E ALBANENE ® 10 8465

MADE IN U.S.A.

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



A1
B1
A2
B2
A3
B3
A4
B4
B24
E12
B8
A24
A12
A8
B17
A17
A22
B34
A31
A21
B21
B28
A28
B23
A23
B32
A34
+15V
-15V
R64
11K
R2
27K
R3
1K
U1
R1
22K
R-1
100K
R66
15K
CR
15
C1
22UF
25V
Q1
R62
100K
C13
.01
C5
.01
R17
1K
R7
470
C4
27PF
C14
.01
C16
.01
U3
LM201AH
R63
15K
R5
CR16
Q16
2N3382
U4
LM318H
C11
56PF
C9
.01
VR2
3.9V
CR10
R26
4.7K
R24
47K
R15
1.5M
R21
R20
R18
12K
R19
B33
A13
A20
A25
A29
B29
B20
B25
B13
B11
B15
B22
B27
B31
U5
SN7404
C8
100PF
C7
100PF
R4
+5V
VR3
1N5231
C12
22UF
+20V
270
R27
4.7K
R28
2K
Q4
2N5087
Q5
2N5087
R34
2K
R35
2K
4.7K
Q6
R36
4.7K
R37
2K
R38
2K
Q7
2N5087
A30
R47
B30
R49
1K
Q11
R51
Q12
R52
3.3K
Q13
2N3391
R54
1K
A26
Q14
R56
CR14
R57
B26
R58
R59
100
3W
W.W.
Q15
2N3391
1K
R60
-20V
B10

COMPONENTS MOUNTED ON 'B' SIDE OF BOARD

ALL DIODES (CR) 1N4446

ALL RESISTORS IN OHMS, 1/4 W, 2%, METAL FILM

ALL CAPACITORS IN MF

* FACTORY SELECT (1/4W 2% M.F.)

HIGHEST COMP. DES. USED:

R - 66
C - 6
CR - 6
VR - 3
Q - 6
U - 5

	525	
NEXT ASSY	USED ON	QTY
APPLICATION		

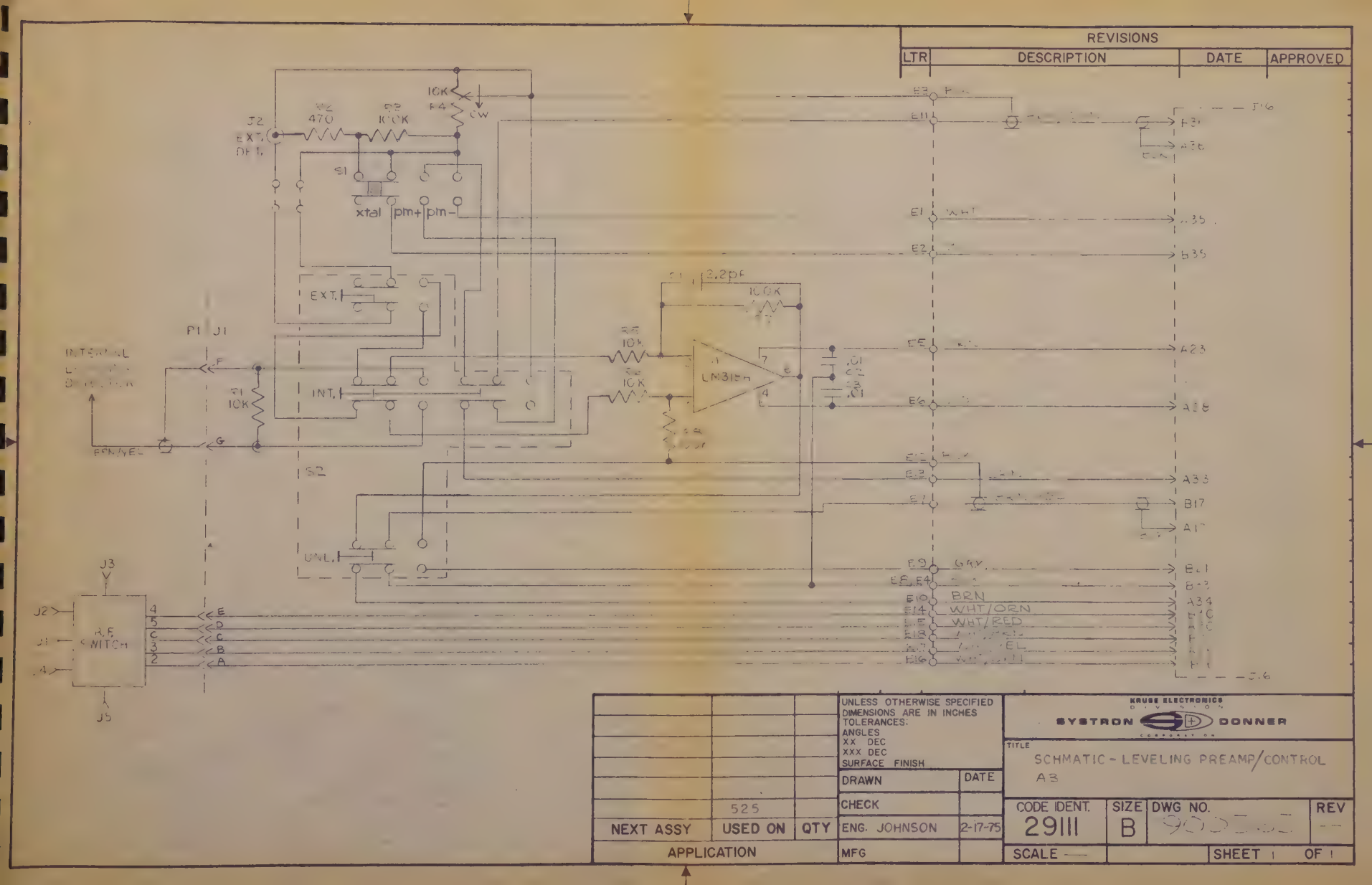
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
ANGLES ±
XX DEC ±
XXX DEC ±
SURFACE FINISH

	DATE
DRAWN	
CHECK	
ENG. JOHNSON	3-3-75
MFG	

KRUSE ELECTRONICS
SYSTRON DONNER

TITLE SCHEMATIC - A.M.CONTROL ASSY.

CODE IDENT.	SIZE	DWG NO.	REV
29111	C	900506	
SCALE		SHEET	


REVISIONS
LTR
DESCRIPTION
DATE
APPROVED
J2
EXT. DET.
470
100K
10K
R4
CW
S1
xtal
pm+
pm-
EXT.
INT.
UNL.
P1
J1
INTERNAL
PANEL
R1
10K
S2
C1
3.2pF
100K
R5
10K
R6
10K
LM318H
.01
C2
C3
.01
J3
J2
J1
J5
R.F. SWITCH
E
D
C
B
A
J16
E3
E11
E1
E2
E5
E6
E12
E13
E7
E9
E8, E4
E10
E14
E15
E18
E16
WHT
GRY
BRN
WHT/ORN
WHT/RED
A23
A38
A33
B17
A1
A34
B35
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES:
ANGLES
XX DEC
XXX DEC
SURFACE FINISH
DRAWN
DATE
CHECK
ENG. JOHNSON
2-17-75
MFG
525
NEXT ASSY
USED ON
QTY
APPLICATION
KRUSE ELECTRONICS DIVISION
SYSTRON DONNER CORPORATION
TITLE
SCHMATIC - LEVELING PREAMP/CONTROL
A3
CODE IDENT.
29111
SIZE
B
DWG NO.
REV
SCALE
SHEET 1 OF 1

DATE	SYM	REVISION RECORD	AUTH	DR	CK

A4 PASS TRANSISTOR SUB ASSY

A5 POWER SUPPLY SUB ASSY

NOTES, UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE 1/4W, 2%, METAL FILM.
2. ALL RESISTORS LABELED ARE 1W FIXED COMP
3. ALL RESISTORS LABELED 5% OR 10% ARE 1/4 W WIREWOUND
4. ALL CAPACITOR VALUES ARE MFD TANAD, 500V MICA.
5. * INDICATES VALUE SELECTED AT TEST.

TOLERANCES (EXCEPT AS NOTED)			
DECIMAL ±		SCALE	DRAWN BY
			APPROVED BY
FRACTIONAL ±	TITLE	SCHEMATIC DIAGRAM POWER SUPPLY	
ANGULAR ±	DATE	DRAWING NUMBER	

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

ASSY #946294
"A1"

P1

COMPASS MODULE (A2)

E-W MODULE (A3)

CONNECTS

PROCEEDS TO A...
PROG. SEL. (7...

PLUG IN
SELECT

E8
E4
E5
E6
E7
E8
9
0
11
12
1

LM 311A

E23
E30
E21
E22
E23
E24
E25

E29
E30
E31
E32

E14
E15
E16
E17
E18
E19
E20

E1
E41

WHT/BRN

R10
R11
R1

BRN

GRY
A1 E16

A2 E15 WHT/BRN

ON-OFF

4. SEE SHEET 2 FOR SCHEMATIC OF SPECIAL "A2" P.C. ASSY.

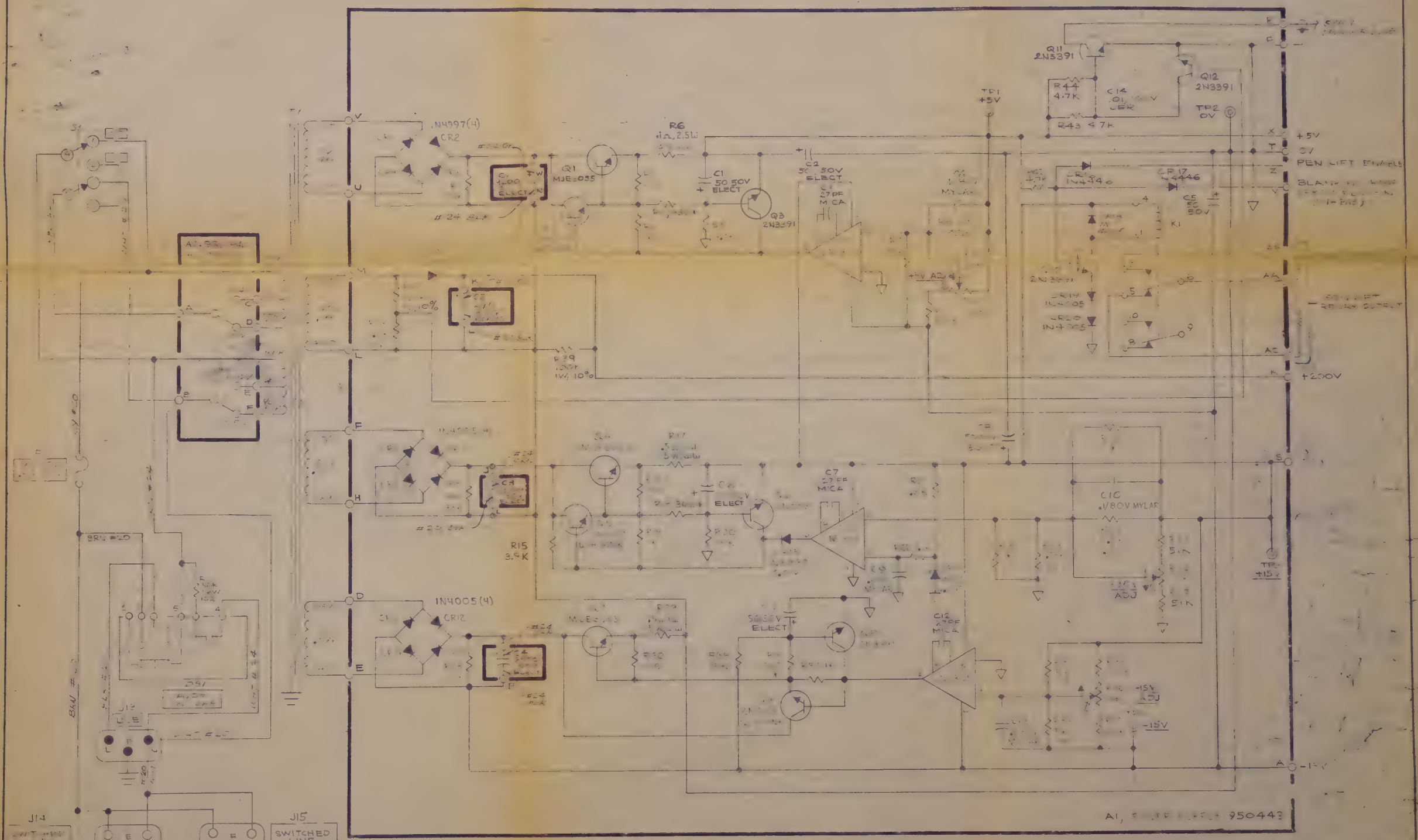
NEXT ASSY	USED ON	QTY
APPLICATION		

SYSTRON DONNER

SIZE	DWG NO	REV
D	2911	

SCALE NONE | SHEET 1 OF

DATE	SYM	REVISION RECORD	AUTH	DR	CK
	A	REVISED PER RED LINE			
	B	R15(3.9K) WAS 6.8K			
	C				


Q11 2N3391
Q12 2N3391
R44 4.7K
R43 4.7K
C14 .01 CER
TP1 +5V
TP2 0V
+5V
0V
PEN LIFT ENABLE
BLANK
+200V
-15V
TP3 +15V
CR16 IN4446
CR17 IN4446
C5 50V
K1
CR14 IN4005
CR15 IN4005
CR16 IN4005
.1
.5
.0
.9
.8
R6 1Ω 2.5W
C1 50 50V + ELECT
C2 50V ELECT
27PF MICA
Q3 2N3391
Q1 MJE2055
CR2 1N4997(4)
#24 BLK
#24 GR
#24 BLU
#24 RED
#24 WHT
#24 YEL
#20 BLK
#20 WHT
#20 GRN
#20 RED
#20 BLU
#20 YEL
#20 ORN
#20 VIO
#20 GRY
#20 BRN
#20 WHT/BLK
#20 WHT/GRN
#20 WHT/RED
#20 WHT/BLU
#20 WHT/YEL
#20 WHT/ORN
#20 WHT/VIO
#20 WHT/GRY
#20 WHT/BRN
#20 RED/BLK
#20 RED/GRN
#20 RED/BLU
#20 RED/YEL
#20 RED/ORN
#20 RED/VIO
#20 RED/GRY
#20 RED/BRN
#20 BLK/GRN
#20 BLK/BLU
#20 BLK/YEL
#20 BLK/ORN
#20 BLK/VIO
#20 BLK/GRY
#20 BLK/BRN
#20 GRN/BLU
#20 GRN/YEL
#20 GRN/ORN
#20 GRN/VIO
#20 GRN/GRY
#20 GRN/BRN
#20 BLU/YEL
#20 BLU/ORN
#20 BLU/VIO
#20 BLU/GRY
#20 BLU/BRN
#20 YEL/ORN
#20 YEL/VIO
#20 YEL/GRY
#20 YEL/BRN
#20 ORN/VIO
#20 ORN/GRY
#20 ORN/BRN
#20 VIO/GRY
#20 VIO/BRN
#20 GRY/BRN
#24 BLK
#24 GR
#24 BLU
#24 RED
#24 WHT
#24 YEL
#24 ORN
#24 VIO
#24 GRY
#24 BRN
#24 WHT/BLK
#24 WHT/GRN
#24 WHT/RED
#24 WHT/BLU
#24 WHT/YEL
#24 WHT/ORN
#24 WHT/VIO
#24 WHT/GRY
#24 WHT/BRN
#24 RED/BLK
#24 RED/GRN
#24 RED/BLU
#24 RED/YEL
#24 RED/ORN
#24 RED/VIO
#24 RED/GRY
#24 RED/BRN
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#24 BLU/YEL
#24 BLU/ORN
#24 BLU/VIO
#24 BLU/GRY
#24 BLU/BRN
#24 YEL/ORN
#24 YEL/VIO
#24 YEL/GRY
#24 YEL/BRN
#24 ORN/VIO
#24 ORN/GRY
#24 ORN/BRN
#24 VIO/GRY
#24 VIO/BRN
#24 GRY/BRN
R39 .30Ω 1W, 10%
R15 3.9K
R17
C7 27PF MICA
C10 .1 50V MYLAR
C12 47PF MICA
C11 .1 50V ELECT
C16 .1 50V MYLAR
R30
R31
R32
R33
R34
R35
R36
R37
R38
R40
R41
R42
R45
R46
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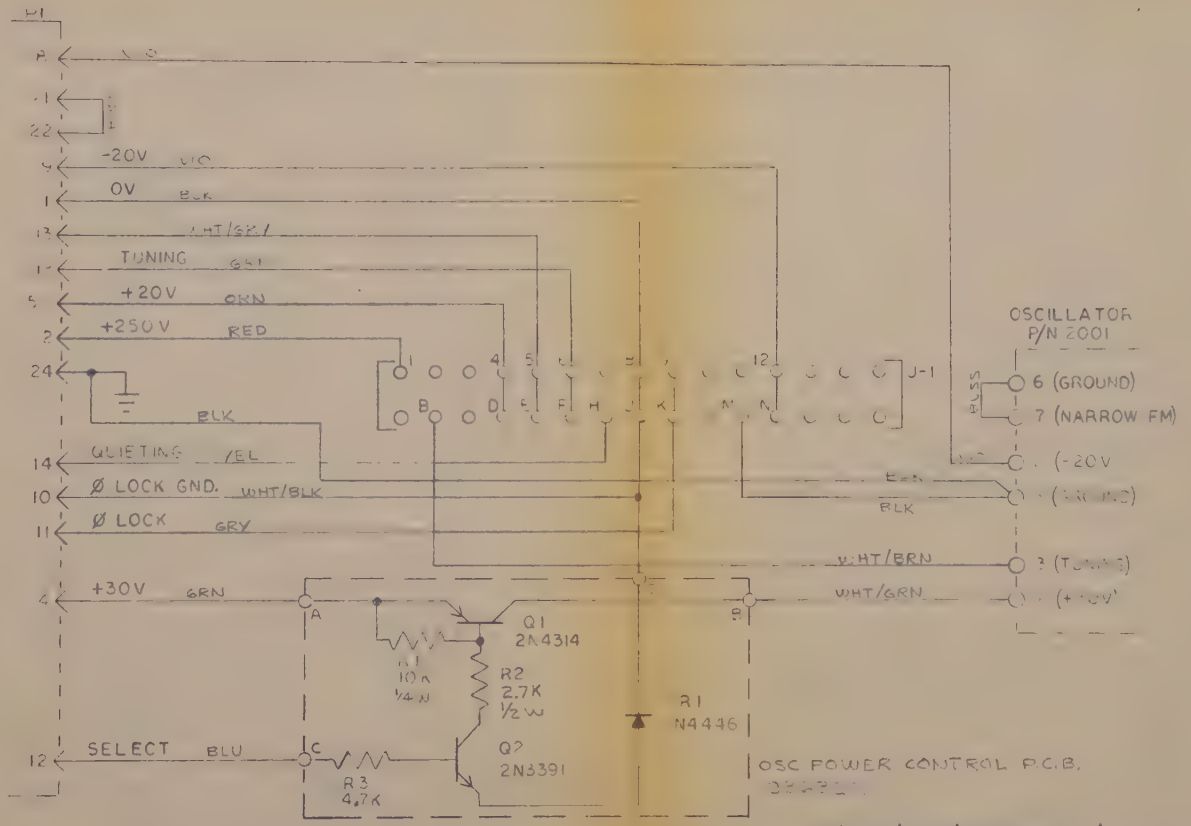
R78
R79
R80
R81
R82
R83
R84

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



			UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ANGLES XX DEC XXX DEC SURFACE FINISH		
			DRAWN J. T.	DATE	
	525-21		CHECK		
NEXT ASSY	USED ON	QTY	ENG.		
APPLICATION			MFG		

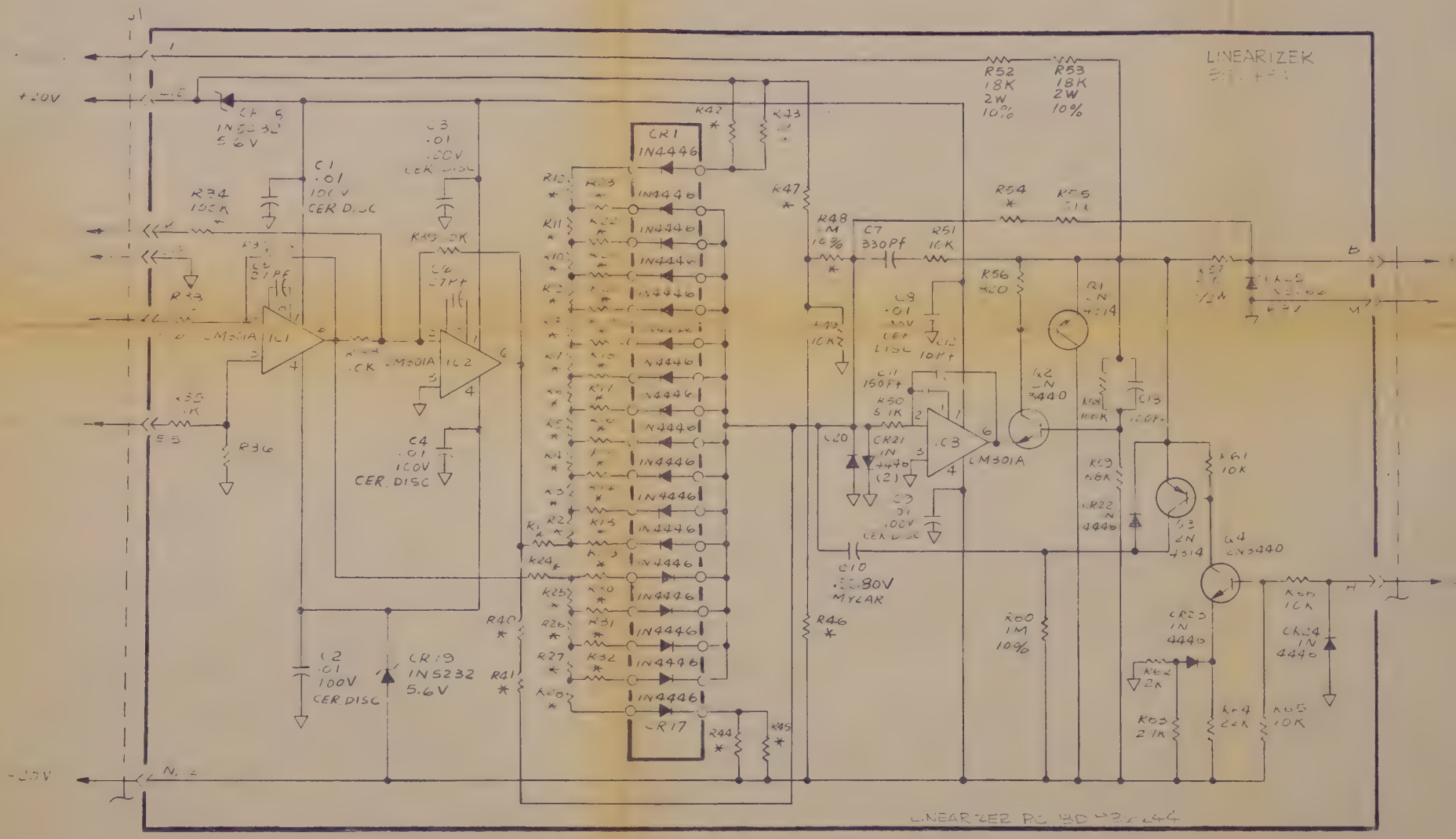
KRUSE ELECTRONICS
SYSTRON DONNER

TITLE
SCHEMATIC – VARACTOR TUNED OSC. MODULE, 500-1000 MHz

CODE IDENT.	SIZE	DWG NO.	REV
29111	B	[illegible]	

SCALE —— SHEET 1 OF 1

DATE	SYM	REVISION RECORD			



NOTES:

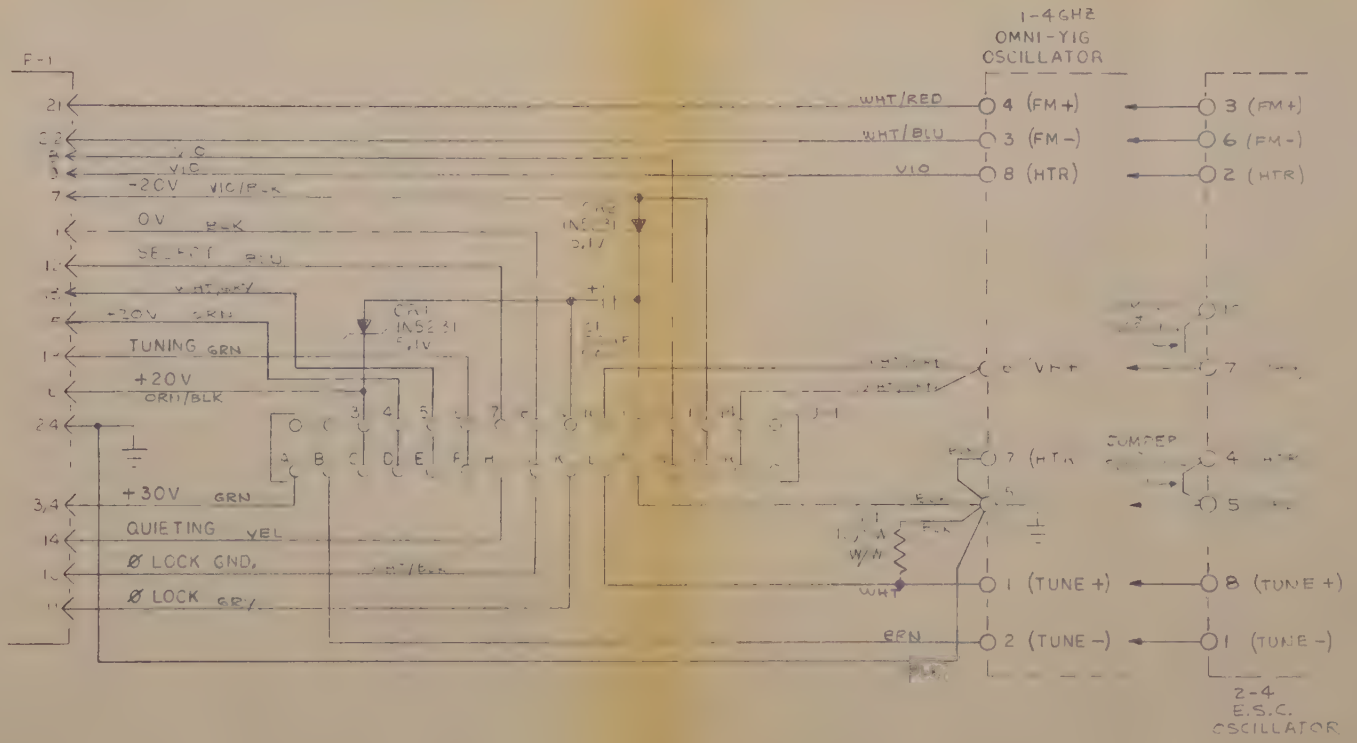
1.) UNLESS OTHERWISE SPECIFIED:
- 1A. ALL RESISTORS IN OHMS, 1/4W, 2%, METAL FILM
- 1B. ALL RESISTORS LABELED 5% OR 10% ARE 1/4W FIXED COMP
- 1C. ALL RESISTORS LABELED 1% OR, 1% WW ARE WIRE WOUND
- 1D. ALL CAPACITORS IN MICROFARADS, 500V, MICA

2.) * INDICATES VALUES SELECTED AT TEST

TOLERANCES (EXCEPT AS NOTED)			
DECIMAL ±	570 SERIES	SCALE	DRAWN BY / APPROVED BY
FRACTIONAL ±	TITLE: SCHEMATIC DIAGRAM LINEARIZER		
ANGULAR ±	DATE: 2-21-73	DRAWING NUMBER: C900424	

K+E ALBANENE ® 10 5468 ENGINEERS STANDARD PURP

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



			UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES. ANGLES XX DEC XXX DEC SURFACE FINISH
			DRAWN — DATE —
	525-03		CHECK
	525-4		ENG.
NEXT ASSY	USED ON	QTY	MFG
APPLICATION			

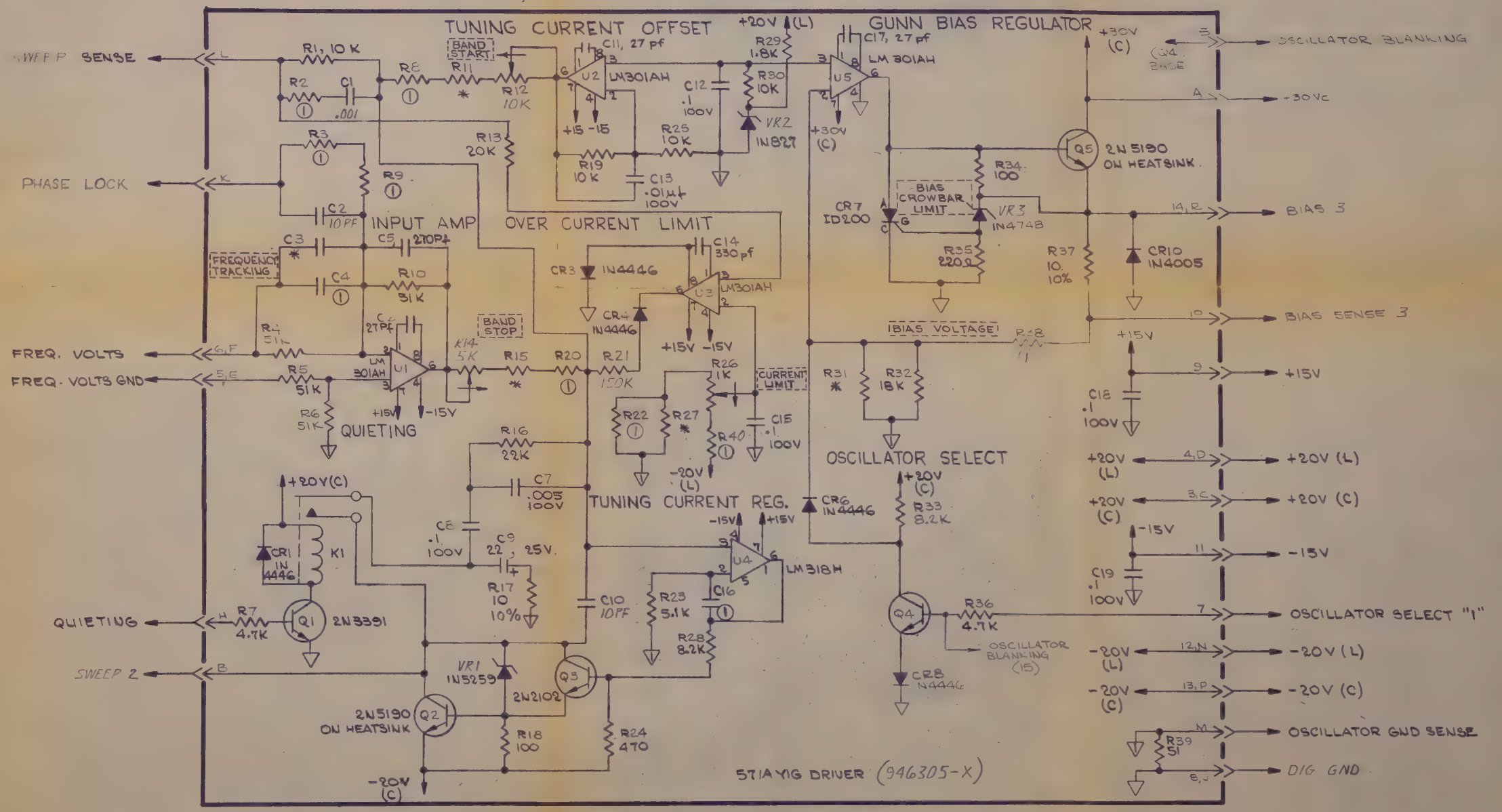
KRUSE ELECTRONICS
SYSTRON DONNER CORPORATION

TITLE
SCHEMATIC-YIG TUNED OSC. MODULE
1-4GHZ

CODE IDENT.	SIZE	DWG NO.	REV
29111	B	900570	

SCALE — SHEET 1 OF 1

DATE	SYM	REVISION RECORD	AUTH	DR.	CK.
1-74	–	ENG. RELEASE 217			
4-9-75	A	INCORP E.O. 10653 REL TO PRO E.O. 10929			



NOTES: UNLESS OTHERWISE SPECIFIED.

1) ALL RESISTORS ≤ 150K ARE 1/4W, 2% M.F.
2) ALL RESISTORS > 150K ARE 1/4W, 10% COMP.
3) * INDICATES VALUES SELECTED AT TEST.
4) ① SEE CHART. (SHEET 2) FOR VALUES
5) ALL CAPACITORS < .001uf ARE 500 V, 5% MICA.
6) ALL POTENTIOMETER ARROWS INDICATES CW ROTATION.
7) ALL RESISTOR VALUES ARE Ω
8) ALL CAPACITOR VALUES ARE µF

TOLERANCES (EXCEPT AS NOTED)	KENNEDY ELECTRONICS SYSTRON DONNER	
DECIMAL ± ~	USED ON: 57A-1 SERIAL NO:	SCALE ~ DRAWN BY T RHODES
FRACTIONAL ± ~	TITLE SCHEMATIC DIAGRAM YIG DRIVER	APPROVED BY
ANGULAR ± ~	DATE 1-4-74	DRAWING NUMBER 900500 REV A

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
	SEE SHT 1		

COMPONENT VALUE CHART

	[illegible]	[illegible]	ASSY NO. 946305-1 (571A-2)
C4	.001 µF 10% 200V (157010)	470 PF, 5%, 500V (155515)	.001UF, 10%, 200V (157010)
C16	15 PF, 5%, 500V (155463)	5 PF, 5%, 500V (155460)	15 PF, 5%, 500V (155463)
R2	[illegible] (471452)	6.2K, 2%, 1/4W (471451)	6.8K, 2%, 1/4W (471452)
R3	30K, 2%, 1/4 W (104872)	180K, 10%, 1/4 (475650)	75K, 5%, 1/4 W (101613)
R8	120K, 2%, 1/4 W (471482)	56K, 2%, 1/4 W (471474)	120K, 2%, 1/4W (471482)
R9	510K, 5%, 1/4 W (101611)	1M, 10%, 1/4 W (475678)	560K, 5%, 1/4W (101687)
R38	36K, 2%, 1/4 W (471469)	22K, 2%, 1/4 W (471464)	36K, 2%, 1/4W (471469)
R20	82K, 2%, 1/4 W (471478)	27K, 2%, 1/4W (471466)	82K, 2%, 1/4W (471478)
R22	5.1K, 2%, 1/4 W (471449)	9.1K, 2%, 1/4W (471455)	5.1K, 2%, 1/4W (471449)
R40	47K, 2%, 1/4 [illegible] (471472)	3[illegible]K, 2%, 1/4W (471467)	47K, 2%, 1/4W (471472)

NEXT ASSY	USED ON	QTY
APPLICATION		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES:
ANGLES ±
XX DEC ±
XXX DEC ±
SURFACE FINISH

		DATE
DRAWN		
CHECK		
ENG.		
MFG		

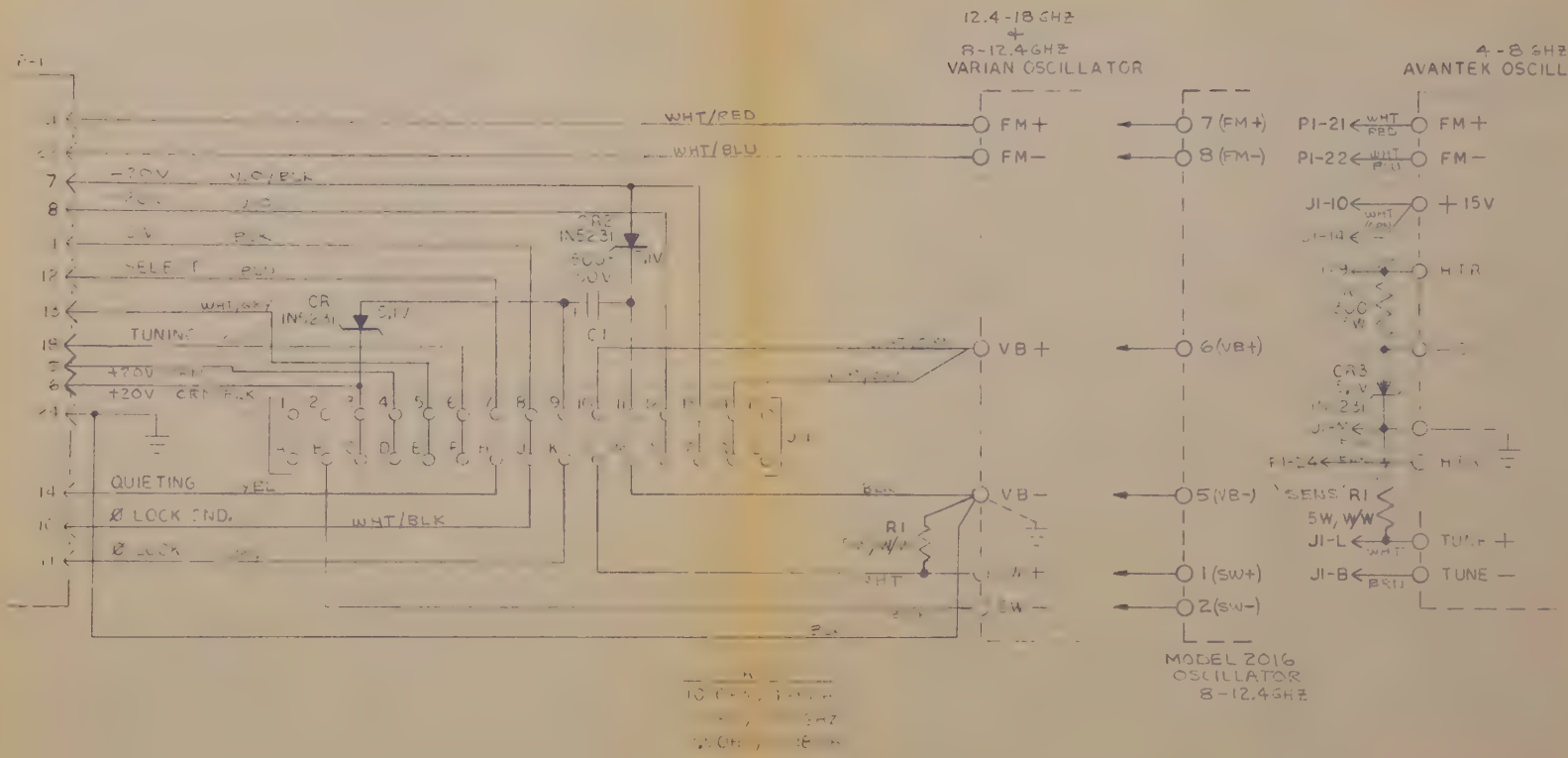
KRUGE ELECTRONICS
SYSTRON DONNER

TITLE [illegible]

CODE IDENT.	SIZE	DWG NO.	REV
29111	C	[illegible]	

SCALE [illegible] SHEET [illegible] OF [illegible]

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



			UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES XX DEC XXX DEC SURFACE FINISH		
			DRAWN	DATE	
			CHECK		
NEXT ASSY	USED ON	QTY	ENG.		
APPLICATION			MFG.		

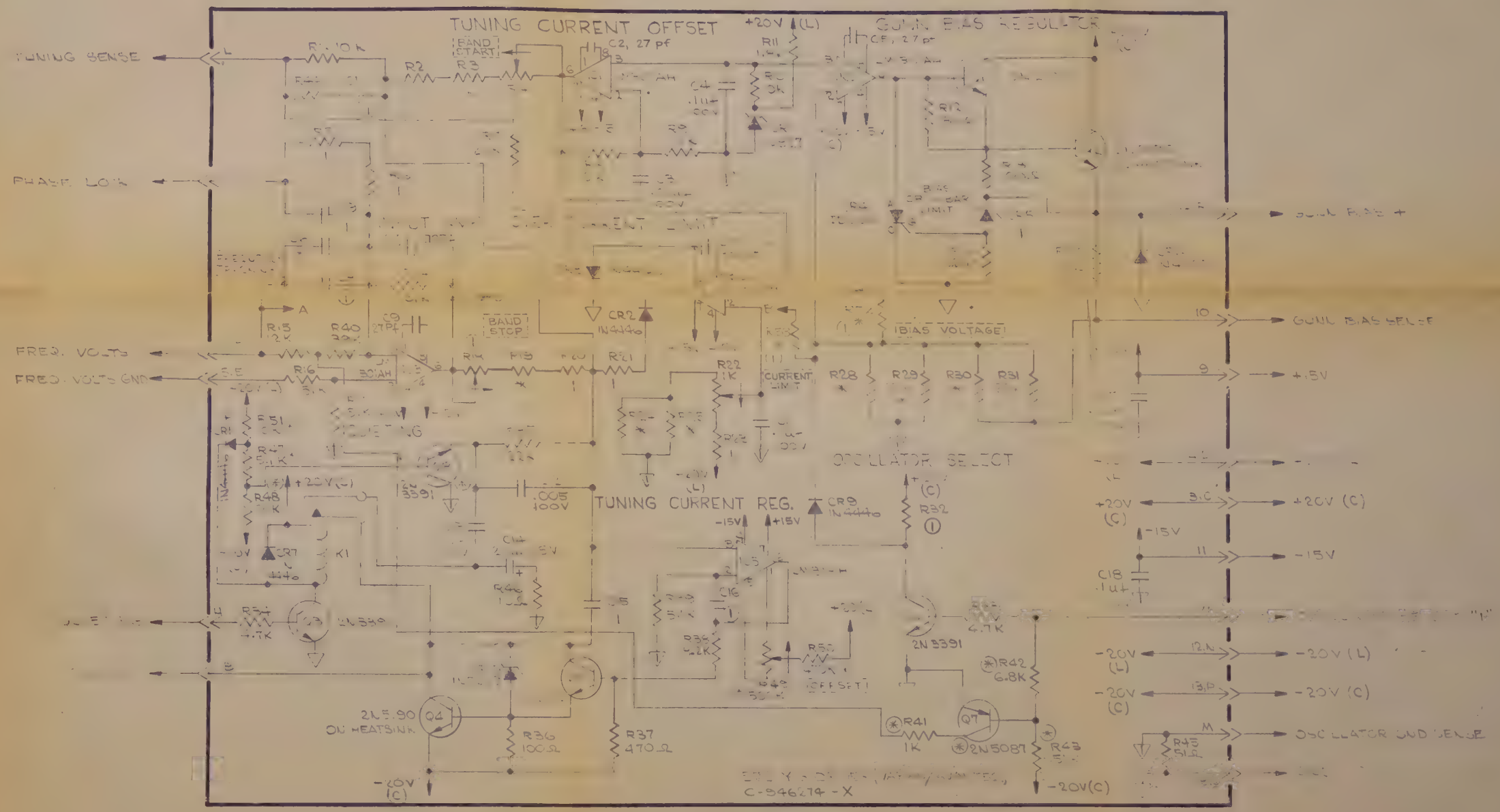
KRUSE ELECTRONICS
SYSTRON DONNER

TITLE
SCHEMATIC—YIG TUNED OSC. MODULE
4-18 GHZ

CODE IDENT.	SIZE	DWG NO.	REV
29111	B		

SCALE — SHEET 1 OF 1

DATE	SYM	REVISION RECORD	AUTH	DR	CK
	H	ENG. RELEASE	MED		
	B	REVISED PER ECO	447		
	L				
	D	REV PER ECO			
	E				



NOTES: UNLESS OTHERWISE SPECIFIED.

1) ALL RESISTORS ≤ 150K ARE 1/4W, 2% M.F.
2) ALL RESISTORS ≥ 150K ARE 1/4W, 10% COMP.
3. * INDICATES VALUES SELECTED AT TEST.
4) ① SEE CHART, C-900407 SHEET 2 OF 2.
5) ALL CAPACITORS < .001µf ARE 500 V, 5% MICA.
6) ALL POTENTIOMETER ARROWS INDICATES CW ROTATION.

TOLERANCES (EXCEPT AS NOTED)			
DECIMAL ±		SCALE ~	DRAWN BY / APPROVED BY
FRACTIONAL ±	TITLE		
ANGULAR ±	DATE	DRAWING NUMBER C-900407 SHT 2 OF 2	REV

K+E ALBANENE @ 10 8466 ENGINEERS' STANDARD FORM

DATE	SYM	REVISION RECORD	AUTH	DR	CK
		SEE SHT 1			

REF. DESIGN.	4-8 AVANTEK ML 946274-1	8-12.4 VARIAN ML 946274-2	12.4-18 VARIAN ML 946274-3	4-6 AVANTEK	4-7 AVANTEK ML 946274-8	7-11 VARIAN ML 946274-9	7-12 VARIAN	12-18 VARIAN	12.4-18.5 VARIAN	7.5-12.0 VARIAN	12.0-18.5 VARIAN
R2	39K	62K	56K	39K	39K	68K	68K	56K	56K	68K	56K
R4, R18	5K	5K	10K	5K	5K	5K	5K	10K	10K	5K	10K
R5	2.2M	2.2M	2.7M	1M	1.5M	1.8M	1.8M	2.7M	2.7M	2.2M	3.3M
R6	JUMPER	100K	270K	150K	150K	180K	270K	390K	470K	100K	JUMPER
R20	27K	75K	120K	51K	36K	82K	68K	110K	110K	75K	110K
R21	91K	180K	330K	91K	91K	180K	180K	330K	330K	180K	330K
R23	100K	330K	470K	120K	110K	330K	330K	470K	470K	330K	470K
R32	10K	24K	24K	10K	10K	24K	24K	24K	24K	24K	24K
R44	6.8K	470Ω	470Ω	6.8K	6.8K	470Ω	470Ω	470Ω	470Ω	470Ω	470Ω
C1	.001μf	.01μf	.01μf	.001μf	.001μf	.01μf	.01μf	.01μf	.01μf	.01μf	.01μf
C15, C16	10pf	5pf	5pf	10pf	10pf	5pf	5pf	5pf	5pf	5pf	5pf
C19	10pf	39pf	33pf	22pf	15pf	39pf	39pf	33pf	33pf	39pf	27pf
CR5	IN5247	*	*	IN5247	IN5247	*	*	*	*	*	*
C8	.001μf	.0033μf	.0033μf	.001μf	.001μf	.0033μf	.0033μf	.0033μf	.0033μf	.0033μf	.0033μf
R52	*	∞	∞	*	*	∞	∞	∞	∞	∞	∞
R53	∞	*	*	∞	∞	*	*	*	*	*	*

TOLERANCES (EXCEPT AS NOTED)				
DECIMAL ± ~	USED ON : 572 SERIAL NO:	SCALE ~	DRAWN BY	
			APPROVED BY	
FRACTIONAL ± ~	TITLE YIG DRIVER (VARIAN/AVANTEK) SELECT-BY-BAND COMPONENTS.			
ANGULAR ± ~	DATE 11-30-72	DRAWING NUMBER C-800407 SHT 2 OF 2		REV F

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